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S. A. E. SUMMER MEETING

Automotive Engineers Consider Future of Industry

Held at Ottawa Beach, Mich., the summer meeting of the S. A. E. is the largest in its history. Credits, adverse legislation and the fuel situation are discussed as the most important problems and standardization action is taken on several subjects. The visiting engineers have five days of work and play.

OTTAWA BEACH, Mich., June 21.

OPENING the biggest convention the Society of Automotive Engineers has ever held, with an expected attendance of over 900, the Hotel Ottawa today presents a busy appearance. The meeting this year is a five-day conference and, as we go to press, the sessions have taken on an importance fully in accord with the carefully planned program.

The Standards Committee meeting was well attended. Although most of the matters were of a routine nature, the reports of the Electric Lighting and some of the other divisions came in for a great amount of discussion.

All four hotels and a number of the cottages at Ottawa Beach, on the shore of Lake Michigan, have been chartered for the occasion. Many of the engineers and the associates have brought their wives and are taking advantage of the elaborate sports program to combine pleasure with business. Some \$3,000 have been spent on prizes for the various sports events.

President J. G. Vincent struck the keynote of the meeting and the activities of the Society in his address. He reviewed the past six months and the outlook for the next period from the S. A. E. standpoint. He recalled the remarks he made at the dinner in New York in connection with the winter meeting of the Society when the increased opportunities were pointed out and the full cooperation of the membership was urged.

He briefly reviewed the work and growth of the organization and commented particularly on the work of the Council, Membership Committee, Standards Committee and the activities and future programs of the Fuel, Science of Truck Operation and Highway Engineering Committees. He told how the increased scope of the Society had made necessary the use of the entire seventh floor of the Engineering Building in New York and indicated that the future work of the organization must parallel the big problems ahead.

Problems of the Industry

AUTOMOTIVE credits, adverse legislation, the fuel situation, highway construction, the development of truck transportation and the building up of an aeronautic industry were placed before the S. A. E. attendants as being subjects of the first importance. Credits were taken up from the standpoint of the Federal Reserve Board policy. Men of the industry were urged to take part in national and civic affairs.

From the standpoint of aeronautics, the plea was made that commercial development is necessary to maintain the United States in its proper place as a nation building airplanes.

The compelling problems of the immediate future are three in number. They include the effect of the banking policy of the Federal Reserve Board which has resulted in instances of discrimination against the automobile industry, the adverse legislation against automobile transportation and manufacture, and, finally and of the greatest importance, the decline of the fuel reserve.

President Vincent traced the development of the financial situation which has resulted from the effort of the nation's bankers to curb speculation. He showed the serious effect of the action on the part of some bankers to put the automobile on the non-essential list and pointed out the real use of the automobile in developing both the rural and urban districts of the nation. The growth in value of America's farms from \$400,000,000 in the ten years previous to 1900 to an increase of \$1,300,000,000 in the sixteen years following with a less rapid growth in population, he stated, was due in no small degree to the motor car.

While no arguments have been brought against the truck as an essential, Colonel Vincent feels that dealers handling both trucks and passenger cars may be discriminated against. In 1919 the wholesale value of cars and trucks produced in this country was \$1,855,000,000, and with accessories, etc., this value would readily be increased to \$2,500,000,000. Consequently, it is impossible to state that an industry of this size is founded upon a product that could be called a non-essential.

In watching legislative matters, President Vincent urged that S. A. E. men take an active interest in civic matters. He said there is at present a national movement toward better highways and urged the necessity of building roads that will be actually suitable for the commercial car. During the winter of 1917-18, he said that 1,200,000 tons of freight were moved by trucks, but the high destructiveness on the roads has shown the necessity for building real truck roads. The truck can and must be able to compete with the railroads up to distances of 200 miles, both as regards time and cost, but to do this roads of perhaps very high first cost but relatively lower upkeep must be built.

President Vincent dwelt particularly on the fuel problem and clearly indicated that he considered this to be of prime importance. We now need either substitutes or extreme conservation and, since there are no substitutes available, the first step must be toward conservation. All branches of the industry are affected. Although the better roads which are a help in reducing consumption are primarily of interest in the car and truck fields, tractor, motor boat and stationary engine manufacturers are all affected. All branches must cooperate in getting re-

sults in legislation which will affect roads, recognition of credit requirements by the banks and all other vital matters of direct or indirect concern to automotive development.

On the subject of aeronautics, which President Vincent also dwelt upon at length, he said we must first build an industry around the plane, after which development of the unit will be easy. He said there are two problems: First, the power part, and second, the plane, but the two are inter-related and the engineer must have a knowledge of both. So far as engine development goes, America is second only in the air cooled radial type, but in planes the Europeans are ahead, particularly with the internally trussed all-metal type developed by the Germans. With this type he expected startling developments in the way of great load carrying capacity with but little power, as we now consider it. Ten passenger planes carried by engines of 180 hp. running at more than 100 m.p.h. with a consumption of eight miles per gallon were predicted. Colonel Vincent said that, as this is not a warlike nation, Congress will never sanction a large air fleet. As a result we must depend on our aerial mail service and commercial development to maintain that air supremacy necessary to make the United States safe.

Action was taken today by the S. A. E. Standards Committee and affirmed by the Council and Society on a considerable number of subjects. Most of these were matters of detail. Some even involved the withdrawal of standards already on the S. A. E. records. Practically every one of the recommendations made by sub-committees was adopted without opposition and even without discussion. Chairman A. B. Bachman presided.

"Four aeronautic" recommended practices adopted during the war are to be withdrawn and the recommended practice on systems of measurement, limiting the use of the metric system to "isolated cases" such as spark plug threads, was revised, leaving out the reference to the usage of the army and navy. Proposals were made by the Automobile Lighting division pertaining to head lamp mounting, head lamp brackets, electric incandescent lamps, head lamp nomenclature, and head lamp illumination. All proposals were adopted, except, at the suggestion of Colonel Vincent, the proposal that means for adjusting the head lamp shall be provided so as to permit a change in the vertical as well as in the horizontal angle of the head lamps, permitting the horizontal axis to be brought parallel to the axis of the cars without bending any part of the headlamp brackets, was amended by leaving out the words "without bending any part of the headlamp bracket."

The Electric Equipment division recommended electrical instrument and gage mounting dimensions. This was adopted. The Electric Transportation division recommended that that end of the industrial truck or tractor on which the controls are located shall be designated the front end, but this was referred back. A proposed clearance radius definition was amended to include both the maximum outside clearance radius and the minimum inside clearance radius. Recommendations concerning brake control and storage battery trays were adopted.

Standardization in engine design was carried one step further by the adoption of a series of connecting rod bolt standards, ranging in diameter from 5-16 in. to 1 in. Three proposals by the Iron and Steel division regarding tungsten steel, valve metal and nickel steel were adopted without opposition. The Miscellaneous division presented a new series of sizes for brake linings cutting

out some previous sizes, a standard thread for oil and grease cup stems and a vacuum tank mounting. All proposals were adopted.

Several recommendations were made by the Motorcycle division, withdrawing and amending some of the standards adopted at the instigation of the Government during the war. Specifications were also presented of a new larger size wheel spoke recently developed. All recommendations were adopted.

The Roller Chain division recommended three series of roller chains—light, medium and heavy. These were prepared jointly with the committees on Roller Chains of the American Screw Mechanical Engineers and in co-operation with the Association of the British Division of Chain Manufacturers. These were adopted without opposition. A proposed standard on roll transmission chain sprockets was also adopted. The revised form of taper fitting with plain or slotted units which was rejected at the winter meeting was adopted with the proviso that certain corrections should be made in the sizes of the units given in accordance with present practice.

A considerable number of proposals were made by the Tire and Rim divisions, covering felloe band tolerances, deflection and set tests of automobile pneumatic tire rims, automobile rim valve holes, carrying capacity of solid tires, motorcycle rim sections, pneumatic tires for passenger cars and commercial vehicles, rim sections and contours for pneumatic tires, pneumatic tire felloe bands and carrying capacities and inflation pressures on pneumatic tires. All of the recommendations were adopted. Several recommendations by the Tractor division were adopted, as was one by the Transmission division covering a control lever ball handle insert.

By a practically unanimous vote the Society went on record as opposed to the compulsory introduction of the metric system and it was decided to instruct the Secretary to inform both Houses of Congress of the action taken. While the sentiment was thus overwhelmingly against its compulsory introduction, the metric system was not without friends at the meeting, however.

The Fuel Question

THE question of fuel and fuel combustion came before the sessions of the S. A. E. as one of the most important subjects of discussion. President Vincent made it one of the outstanding features of his address and the report of the Fuel Committee attracted the attention of entire body. The report is published almost in full elsewhere in this discussion and too much stress cannot be placed upon it.

President Vincent declared the first step in overcoming the dwindling reserves must be conservation, urging that all branches of the industry get together in this regard. The Fuel Committee attacked the problem mechanically, pointing out the necessity for more thorough combustion which would obtain the utmost of power.

Charles R. Underhill, of New Haven, Conn., said that the way to the adoption of the metric system is to adopt it. If we had to make out our bills in pounds, shillings and pence, we would probably go crazy, and if in monetary matters we had found the decimal system superior there was no reason why it should not prove better also for other measurements.

H. M. Crane, of the Wright Aeronautical Corp., said that his firm was using the metric system exclusively.

A. D. T. Libby, of the Splitdorff Electrical Co., said that while it could be easily understood why mechanical engineers should be opposed to the metric system, those members of the Society whose work centered mainly around electrical matters favored it. They made their calculations in the first place in metric or C. G. S. units and then converted their results into English units, which was a roundabout way of doing things. The motion to go on record as opposed to the compulsory introduction of the metric system was made by W. C. Keyes and nearly a dozen members vied in seconding it.

Fuel Situation Demands Conservation

OTTAWA BEACH, June 22.

H. L. HORNING, chairman of the fuel committee, in presenting the report of the committee, praised the co-operation of the different members of the industry who in some cases gave information that is usually of an exceptionally confidential nature.

The committee believes there is no perfect system but thinks the hot spot system is a working possibility at present. There is an engine on exhibition which incorporates a number of the experimental ideas on handling heavy fuel. This engine has developed .585 lb. of fuel per horsepower hour, although it is not a working but an experimental type. The good results are due to turbulence, as shown in the committee's report.

Mr. Horning expressed the wish that this meeting might show more progress than any other. He said the tractor industry had improved 15 points in fuel economy since the winter meeting. He pointed out that the manifold is always wet. He called attention to Dr. Dickinson's engine with a pyrex glass manifold in which floods of gasoline pass through what is ordinarily supposed to be a dry manifold.

Horning stated that the real fuel problem of the day is Henry Ford, because of the number of cars he is turning out, many of which get no more than 11 miles per gallon.

If he would take the recommendations of the fuel committee, said Horning, he would advance the anti-climax in the fuel situation by three years.

The example of the International Harvester Co. in running an engine on heavy oil with devices which represent the work of the fuel committee are of great interest and the speaker urged that members view this unit.

In discussing the report, R. W. A. Brewer, of San Francisco, stated that the fuel committee has confirmed his work of fifteen years on hot spot manifolds. He said that an important feature is that the areas to reach the temperatures in the report must vary with the metals that are used. Cast iron in the manifold will give different results from those of copper or aluminum.

Mr. Brewer pointed out that results on the block do not always give practice results. It is necessary to give attention to after cooling, as it is to bear in mind conditions on a particular job as regards temperature on idling. Radiation from the exhaust may have a marked effect. He has seen conditions where the engine will be cooler at idling. When temperature drops to 110 deg. Fahr., the engine ceased to idle smoothly. In designing a hot spot manifold, it is well to remember that need for design ceases after one-half or three-quarter load. At full load conditions are far easier.

O. H. Ensign, of Los Angeles, in outlining his paper on fuel, stated that on the Pacific Coast there are three grades of fuel, gasoline, distillate and toppings, the latter not being common. Formerly, distillate had an end-point of 430 deg.; it finally reached 480, and was then abandoned. Mr. Ensign's work is based on the idea that the carbureter must give a straight line mixture. In other words, distribution must be perfect.

H. M. Crane, of the Wright-Martin Aircraft Corp., gave notes on design of heavy fuel engines to take care of present day requirements. He blames the fuel manufacturers for many of the difficulties, because they have failed to improve quality. Engines are now on the market that are incapable of handling present fuel. He cited the example of the Hispano engines which, even though run under full load, were tested more economically with high grade gasoline at high cost because there were fewer scored cylinders.

Crane said that, with the present fuel, it will be necessary to make fundamental changes in engine design, possibly going to the Diesel type. Thus far we simply have used heat devices on carbureters and manifolds. These simple changes are not sufficient with present and future fuels. Engines running under full load and constant speed offer little difficulty.

Experience has not demonstrated the high speed engine to be economical or efficient. The closing of the intake valves necessary with this type harms distribution at speeds below 1000 r.p.m. Proper distribution is a function of correct valve timing and this should be laid out to assist it.

Carbureters should be designed really to atomize fuel and then the manifold should properly distribute it. The flow should be directly up hill until the manifold branches to the various cylinders. The manifold should be short to avoid pulsation. The candelabra type of manifold works out well with the six but too much heat is a drawback. Many manifolds have been distorted to get the hot spot, with a result that distribution suffers and more heat than would be otherwise necessary is required.

Prof. Carl A. Norman believes that the present type is not suitable for present fuel. The Diesel engine is not suitable for automobiles, but the automotive steam engine may play an important part in the field in the future. He emphasized the fact that, while compression gives power, it is through expansion; so if supercharging engines are used the expansion ratio must be kept up. However, fuel must be burned thoroughly and quickly. The combustion must be speeded up by turbulence, double plugs and other methods to fatten the expansion curve are necessary.

W. E. Lay, of the University of Michigan, in outlining his paper, said the statement that more than 250,000 gal. of gasoline are wasted every day through leaky and badly adjusted carbureters is under the truth.

P. S. Tice, of the Stewart-Warner Speedometer Corp., in his paper deals with the laboratory experiments at the Stewart-Warner plant. These are being published in current issues of AUTOMOTIVE INDUSTRIES.

R. L. Welch, secretary of the American Petroleum Institute, stated that the problem of the hour is conservation of fuel. He said that if he talked a week he could not amplify that statement. Last year there were only 50 barrels of crude available for each car. This year there will be but 40, and next year 35. There will be local shortages at certain seasons, but he believes that there will be a solution if the United States Government co-operates, the automotive industry conserves and the fuel industry also helps.

THE FUEL REMEDY

DISCUSSION of the fuel report brought forth the declaration by Secretary Welch of the American Petroleum Institute that oil consumption in April showed a yearly deficit ratio of some 50,000 barrels. Conservation, with co-operation between the United States Government, the automotive industry and the fuel interests, was his recommendation to overcome the threatened difficulties.

The engineers, in seeking a remedy, turned to the hot-spot system, which was thought to be a working possibility. They recognized the need for higher engine economy and declare this must be taken up by the industry as being of the highest importance.

The consumption in 1919 was 377,000,000 barrels. In April of this year consumption was at the rate of 452,000,000 barrels per year. The changes in prices occurred because of the change in ratio of consumption to production. We are producing only at the rate of 402,000,000 gallons per annum.

Questions were asked by Coker Clarkson, secretary of the S. A. E., on the future of the fuel, its quality, quantity and price. Mr. Welch replied that if he were an automotive engineer he would plan to use present day fuels. There is no use designing for kerosene. The price of kerosene is rising more rapidly than gasoline and, with lamps continuing to burn, it will not be long before they are nearly the same. It will not be long before the oil industry will be cracking nearly all the kerosene and gas oils and getting gasoline from them.

As regards to shale, there is no real practical method for getting this gasoline but this and other kinds of deposits will sometime be available. As regards casinghead, this becomes a matter of proper blending. It must not be blended with too heavy a product. H. M. Crane asked if the petroleum industry can curb improper blending of kerosene and casinghead. Mr. Welch replied that the abuse, as far as he is aware, is small and some of the state inspection statutes have turned out to be a disadvantage to the public.

"A great deal more cracking will soon be in use. As a layman, he feels it absurd that people should require 80 or 90 hp. to go 20 m.p.h.," Mr. Welch said. "A certain make of car which has been mentioned can get 30 miles per gallon. Is not that the answer?"

Prices are not a result of combination, he said, but of demand, and to-day there is more competition in the oil business than in any other. The independents refined 51 per cent. of the output in 1919. The export business is too small to be a factor, and it would be bad business anyway to embargo any product on which we are really on an importation basis.

About 23 per cent. of the crude in 1919 was turned into gasoline. This rate is increasing with the use of the cracking process. Of the Mid-Continent crude, about 50 per cent. is available. In the Mid-West, cracking is more usual than on the Pacific Coast.

H. M. Crane, who presided, closed by stating that the public must be educated to economy. He said the public must demand gasoline economy on the part of the car, and it is up to the industry to keep this in the public eye. Dr. H. C. Dickinson, of the Bureau of Standards, went roughly through the fuel committee report and emphasized its main issues, but disagreed with some of the points designated at which heat should be applied to the manifold.

S. A. E. SUMMER MEETING

Meeting the Combustion Requirements
of Present Fuels

Fuel was one of the most important subjects before the S. A. E. at its summer session this week. The report of the Fuel Committee, which was headed by H. L. Horning, was made on the morning of June 22.

THE report centers on the preparation of proper combustible mixtures from the less volatile gasolines and involves consideration of questions of vaporization and distribution.

A dry mixture gives the best distribution and most complete combustion. With increasing end-points of distillation for the fuels there is an increasing need of heat application. Attempts to attain a thoroughly dry mixture under all temperature conditions with high end-point fuels may result in so high a temperature of the mixture that an appreciable decrease in maximum power is brought about by a reduced weight of air charge. With fuels of relatively high end-points, where the highest power output is desired consistent with the fuel characteristics, a fog mixture permits of excellent distribution and practically perfect combustion.

A fog can exist at a much lower temperature than a dry mixture and will, therefore, permit of an increase in power by allowing a greater charge weight per stroke.

The bulbs or thermocouples give wet-bulb readings which are too low. Just above the throttle there is a drop in temperature below that of the air entering the carbureter due to the vaporization of the lighter constituents of the fuel and the depression in the intake. When the mixture strikes the heated surface the fuel separates and vaporizes.

Readings of temperatures of mixtures entering the cylinder ports have been found to indicate that mixtures should have a temperature at full load varying with the distillation curve of the fuel. It will be found that if the temperature of the mixture entering the cylinder during full-load performance is about 150 deg. fahr. lower than the temperature at which 50 per cent of the fuel comes over during distillation, good results are attained.

A remarkably constant mixture temperature is maintained by any of the designs shown in Figs. 1 to 5 at full-load performance at all speeds, provided they are well

worked out. The engineer must be guided entirely by the temperatures at no-load and full-load in relation to the results to guide him. At no-load performance a higher mixture temperature has been found to exist.

It is desirable to keep the temperatures below a certain maximum to avoid poor accelerating ability and give desirable operation. When the temperatures of the mixture are too high there is very noticeable loss in power and a tendency of the engine to backfire when the throttle is closed quickly to extreme idle.

Likewise when the temperature of the mixture entering the cylinder approaches 190 deg. fahr. lower than that at which 50 per cent of the fuel distills, there is decided tendency to manifold loading on hills or at low-speed pulling, regardless of the design of the heated surface. At this low temperature limit the influence of the cooling water temperature is of major importance.

The lower grades of gasoline require a higher mixture temperature and more heat at the hot surface; hence larger heating areas are necessary. However, judging by a report recently issued by the Bureau of Mines, it appears reasonably certain that the petroleum industry can for the next three years provide fuel corresponding to the distillation curve shown in Fig. 6. So far as this fuel is concerned, it would be wise to design apparatus to give a mixture temperature of 127 deg. fahr. under all weather conditions. While this will give a hotter mixture than necessary for lower end-point fuels, the fuel generally available should govern the design.

1. Fig. 1 shows one type of heated-surface manifold. The object of this design is to provide a means of heating the liquid thrown out of the air-stream, with the least possible heating of the air itself. At slow speeds of the mixture the tendency is for the fuel to collect on the wall of the vertical section of the manifold and at the inside corner of the bend *B*. At higher speeds the tendency is

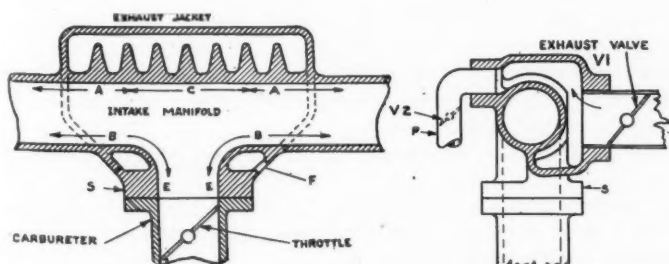


Fig. 1

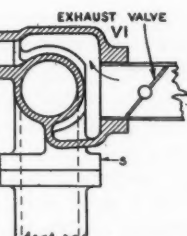


Fig. 2

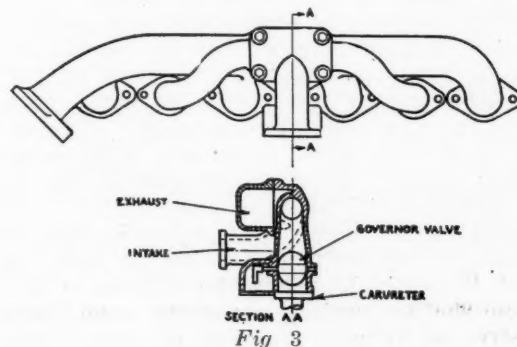


Fig. 3

to collect in the horizontal part of the manifold. At higher speeds the liquid fuel strikes the manifold at C and alternately at A-A, reaching points farther from the intersection as the speeds increase.

2. It has been found of advantage in some cases to reduce the heating surface in an intake tee branch by resorting to jacketing, as indicated by Fig. 2, in which one side only is exposed to the exhaust flame. A satisfactory result has been obtained with this jacketing when the exhaust jacket is connected to the exhaust manifold by a pipe which is not over 6 in. long.

The vaporizing of fuel from a hot surface by exhaust heat is accomplished best by producing as high a surface temperature as possible. The limiting factors are the temperature of the exhaust, the velocity of the exhaust gases, the extent of the surface presented to the exhaust flame, the conductivity of the metal and the amount of deposited liquid fuel. The liquid fuel is in contact with the heated surface for so short a time that it is necessary to have high enough temperatures to vaporize fuels of high end-point quickly, and to supply sufficient heat to maintain these temperatures of the hot surface. The temperature of the exhaust and the heat available drop rapidly after the gas leaves the exhaust port.

Fig. 3 shows the manifold on the Class B military truck engine, which produced satisfactory results. This is an example of a simple way of conducting heat at high temperatures to the mixture, but it may be found to be subject to certain defects listed. Seasonal adjustment can be accomplished by varying the heating of the air.

Fig. 4 illustrates an elbow construction for hot-surface manifold work. There are two areas, A and B, where fuel separation occurs. Slow speeds require heat at B; higher speeds call for heat at A. The hot surface can therefore be concentrated at these points with the least area for all conditions.

The upper portion of Fig. 5 illustrates an application of exhaust to engines where a long vertical intake pipe separates the carburetor from the branch. The two views in the lower portion show sections of this vaporizing device.

A milder heat application is obtained by heavy sections of metal adjacent to the jacketed section as at S, Figs. 1 and 2. They should be avoided because their temperature is lower than directly heated surfaces, but they can be used to advantage only when it is impossible to bring the exhaust gas to the desired spot. They may frequently be used to conduct heat to the carburetor flange, where it is needed because of the spray thrown off from the butterfly-valve at low-throttle opening.

Having described the design and arrangement of heated surfaces and passages for producing an approximate fog mixture, we deal next with the temperatures of the exhaust available as a source of heat and the temperatures of the mixtures which give the best results.

In practice the area of the exhaust-heated surface exposed to the mixture varies from 1 sq. in. for each 15 cu. in. of displacement to 1 sq. in. for each 30 cu. in. displacement of the engine, this estimate of area including the metal which lies sufficiently close to the heated surface to become hot. Flanges in the exhaust stream should be designed so as to present the maximum surface to the exhaust gases without retarding the velocity of these gases. Exhaust passages should be constructed so as to maintain the highest velocity over the heat collecting fins and yet not impose detrimental back-pressures.

When the exhaust gases just leaving the port impinge upon the heated surface the least area per cubic inch displacement is required. When the exhaust is 12 in. or more from the hot surface, the larger area is required. The quantity of the exhaust gases in such a case must

not be less than that conducted by a pipe having the same sectional area as the intake passage.

The amount of heat necessary for good operation depends somewhat upon the carburetor. If the carburetor is of a straight uniform mixture type and set for economical operation, considerably more heat will be required for flexibility than if the carburetor contains a provision for a temporarily rich mixture on acceleration. Richer mixtures are more satisfactory than normal mixtures even in the heated-surface manifolds while the engine is warming up and particularly at low speed with wide-open throttle.

The widespread use of cars and trucks has developed a broad range of conditions under which the engine must operate. The following are among the conditions which must be met by manual-adjustment of temperatures of the mixture by regulating the exhaust flow to the heated surface, or otherwise:

- (1) The temperature under the hood may vary from 0 deg. Fahr. in winter to 150 deg. Fahr. in summer
- (2) The variation between day and night temperatures
- (3) The wide variation in temperature due to latitude
- (4) Variations due to altitude and barometric changes

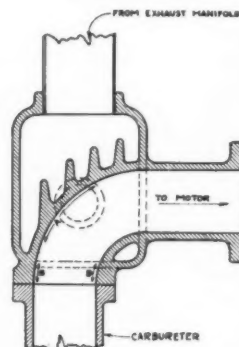


Fig. 4

Most of the above conditions can be successfully met so far as adequate heat is concerned by using care in the design of the manifolds so as to admit adequate exhaust to the heated surface, for sea level and cold service and by providing valves so well made as to cut off part or all of the exhaust to the heated surface for altitude and hot-weather service.

Valves may be used in three locations to regulate exhaust flow, as follows:

- (1) A valve to close the main exhaust passage partially or fully and thus force the exhaust over the heated surfaces. This is used when all of the exhaust is at times needed at the heated surface and usually in cases in which the exhaust must be conducted long distances
- (2) A valve between the exhaust header and the exhaust jacket surrounding the heated surface and regulating the flow to the heated surface, as at V-1 in Fig. 2. This is a most practical arrangement
- (3) A valve such as V-2 in Fig. 2, regulating the exhaust to the atmosphere after the hot gas has passed through the exhaust chamber. This may be considered a refinement and is seldom used

While this report has to do with the preparation by vaporization of the explosive mixtures for the purpose of effecting a satisfactory and economical service from our present fuels, the engineer must keep in mind the other fundamental considerations affecting economy. Attention is briefly called to these factors with suggestion that they be constantly consulted and their importance never overshadowed by any non-essential treatment.

The air standard efficiency established by the Gaseous Explosion Committee of the Royal Society as the most fundamental method of comparing results and expected performances from internal-combustion engines, points out the importance of compression ratios as the method through which we may expect high power and economy from a given engine.

It is therefore important that the engineer shall keep in mind those things which limit the compression ratio in designing the engine or tend to reduce the actual compression in service. Among these considerations the following are important:

With present fuels, compression is governed by such fuel characteristics as tend to allow such a rapidity in

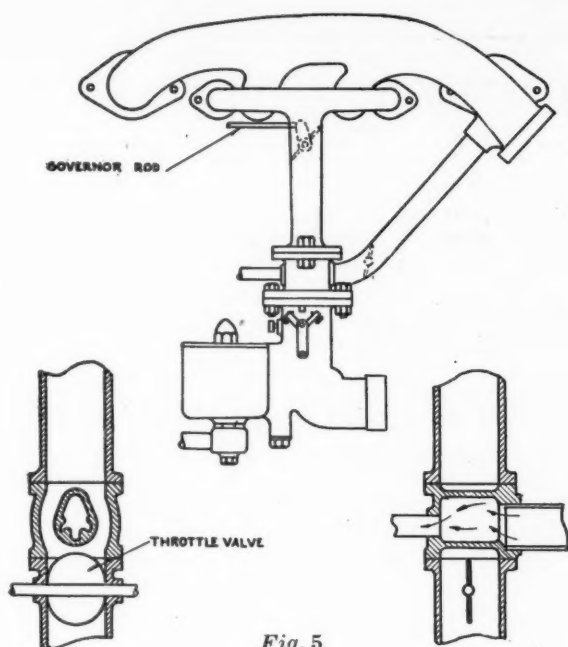


Fig. 5

flame propagation as to produce the phenomena known as "ping pinking," knock or detonation. This limits the compression ratio by making the engine appear rough and thus both power and economy are limited.

The mixture temperature at which an engine will knock due to detonation depends primarily on the fuel. Generally speaking, fuels with contents having boiling points over 350 deg. Fahr. are susceptible to detonation with compressions running over 70 lb. pressure.

Engines have the strongest tendency to detonation when volumetric efficiency is highest, i.e. at the slower speeds. This fact determines the compression permissible in any design.

If an engine is susceptible to carbon deposit due to over-lubrication, it will take very little heating of the mixture to cause knocking. In the case of engines designed so as to have low turbulence of the charge and poorly designed water-jacketing and cooling of the piston or other parts of the combustion chamber, the tendency to detonate limits the allowable temperature of the mixture. When hot air is supplied to the intake of the carbureter this may be removed. This change from preheating the intake air to heating the fuel charge should have no deleterious results and has often shown a marked decrease in the tendency to detonate and an increase in power.

The design of the engine can reduce detonation to minimum in a given fuel by proper attention to these details:

- (1) Turbulence which is promoted by the proper gas velocity past the intake valves
- (2) Keeping all parts of the combustion chamber from exceeding certain maximum temperatures
- (3) Location of the spark-plug
- (4) Shape of combustion chamber
- (5) Preventing the crest of the original explosive wave from impinging on a flat surface which itself can echo back to another flat parallel surface
- (6) The distance of the spark-plug from the nearest opposite surface

Such elements of design as tend to maintain actual compression in service such as

- (1) Good piston and ring design
- (2) Proper lubrication of cylinder, piston and ring surfaces
- (3) Prevention of the warping of the valves due to uneven heating and rotation
- (4) Prevention of the warping of the cylinders due to casting design and proper water distribution

It has been demonstrated that little power is available

from a quiescent mixture. It is absolutely necessary for economy and power that the mixture be as turbulent as possible to promote flame propagation. This is effected primarily by the velocity of mixture past the intake valve which should be between 130 and 165 ft. per sec. Turbulence is improved by certain shapes of combustion chamber, generally such shapes are simple in contour and with few projections to dampen out the turbulence.

Engine timing and its effect on the mixture and its uniform distribution are closely related in economy to the shape of the intake passages. There is a definite relationship between gas velocity by the carbureter, the intake header and branches and valves which gives maximum power and economy.

The engineer must keep in mind that timing and gas passages can be controlled so as to promote a higher relative economy at one-quarter, one-half and three-quarter load than is usually found in the average engine.

The high specific economy which can be attained by hot intake passages and combustion chamber is one factor which suggests serious consideration. High temperature of cylinder walls is desirable, if there is no local overheating. For economy the highest water temperature is advisable without boiling.

Great loss in mileage is common, due to high friction losses in the engine, particularly at the piston surfaces which in most engines account for over 50 per cent of the friction-horsepower loss.

Almost without exception the relative economies at the low loads commonly found in service can be decidedly improved by reducing the unnecessary piston friction losses.

When new designs of manifolds constructed according to the foregoing recommendations have been applied to engines, it will be possible to readjust the carbureter so as to give a leaner mixture with a consequent saving in fuel as well as a more satisfactory general operation.

(Continued on page 1449)

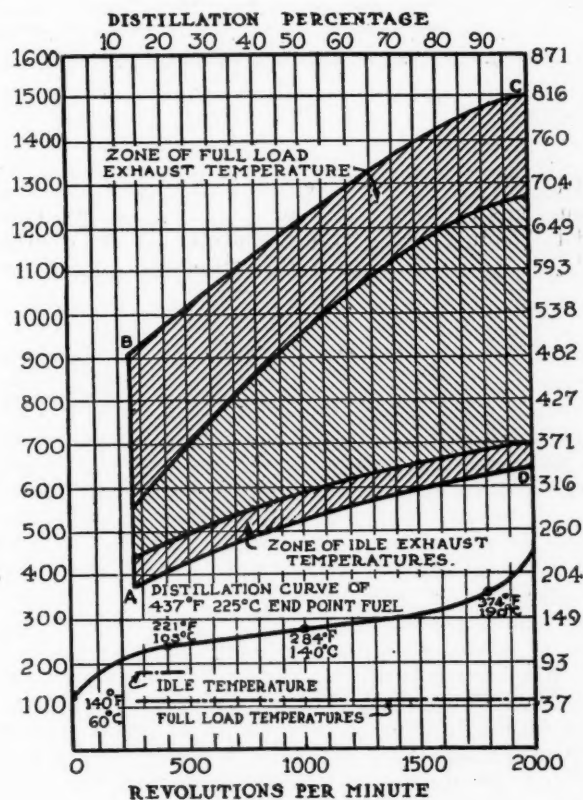


Fig. 6

S. A. E. SUMMER MEETING

The Motor Bus as a Vehicle of Transportation

This paper takes up some of the engineering and operating problems that have confronted one of the largest bus companies in the United States. It likewise predicts future developments and particularizes along what lines such development should proceed.

By G. A. Green*

IN the design, manufacture, and operation of the motor bus, one must come into contact with practically every field of industry. This paper should be considered as an introduction, for the subject is so far reaching that one can at best here only touch lightly upon some of the more interesting aspects. The motor bus industry is of very recent growth. It is, however, rapidly establishing itself in popular favor. Unquestionably, the so-called "jitney" is merely a forerunner. It is, however, fulfilling a useful purpose since it is creating a desire for real bus service. Trackless transportation has unquestionably come to stay and it is confidently anticipated that in the very near future the automotive industry will give this branch of its family something more than a name.

A rather general impression prevails that the average truck chassis can be successfully employed for motor bus operation. We do not hold this view. There certainly are many instances where modified truck and touring-car chassis have been profitably employed for buses, but in such cases had the right type of vehicle been used much more economical, satisfactory, safe, comfortable and convenient operation would have obtained. Furthermore, where financial failures have occurred, many of these could undoubtedly have been avoided, assuming, of course, the employment of the right kind of vehicle.

In my opinion, the average truck chassis is unsuitable for passenger transport because the weight is excessive, particularly the unsprung weight, the center of gravity is too high, the gear ratios are unsuitable, the springs are too rigid, the frames, spring and axle tracks too narrow, the turning radius too wide, the steering too stiff, etc. I believe that an efficient bus corresponds very closely to an enlarged touring car. Briefly, it would be just as unsatisfactory to attempt to use a high-class 12-cylinder touring car for general trucking purposes as it is to expect the average truck to give efficient and economical service when used to haul human freight.

It has been pointed out that motor bus operation is a comparatively new art. The possibilities of improvements, more especially from the standpoint of design, are practically unlimited. This applies with respect to greater comfort and convenience as well as economy of operation.

It is difficult to say what the future type of bus will be. Clearly, different cities have different requirements. In all probability, any large operating company will require at least two distinct types, the double deck for large loads and the single deck for smaller loads, faster operation, express service, etc.

Assuming good roads, wide thoroughfares, and reasonable freedom from overhead structures, the 50 to 60-passenger, very low hung, double-deck vehicles capable of handling a trailer seems to have great possibilities. This class of vehicles jointly operated with the single-deck, one-man controlled, pneumatic-tired bus appears to me as being a logical scheme, especially where peak loads must be handled largely without surface car or subway aid. The development of either type presents immense, but not insurmountable difficulties.

There are those who believe that the trolley car propelled by a gasoline power unit may supersede the present arrangement. In my judgment, this theory will not bear close analysis, for the greatest asset the trolley car has is cheap power. Take this away and the structure falls to pieces. A gasoline-propelled trolley car is a bus, less nearly all the advantages of the latter. It is, of course, true that a much lighter and better design of trolley car could be produced and a gasoline power unit embodied in it. It is equally true that the cost of operation of such a vehicle might be less than existing types of trolley cars, but my contention is that if the same care and attention to design were applied to the conventional article, still better results would be achieved.

The fact is the present trolley car design is more or less crude and out of date. They are as a whole built as strong as possible, not as weak as possible, which is a much more logical and economical procedure. To sum up, trolley car design has not marched with the times.

We believe in centralized unit repairs. This work is carried out in a department entirely separated from the operation end. To permit this, each operating department is allotted a definite percentage of spare units which from time to time are exchanged. In so far as possible, the exchange is made on a mileage basis and we insist that the units are delivered and returned complete in all respects. Operating departments are neither expected nor permitted to make major repairs to units. The centralization of our unit repairs permits of the use of unskilled

*Mr. Green is the general manager of the Fifth Avenue Coach Co. of New York. Paper read before the S. A. E.

labor, and to this end special tools and labor-saving devices have been developed to an unusual degree. Also men are concentrated on each of the various sections and each section has allotted to it complete tool equipment covering its requirements. Engines in particular receive careful attention. Bearings are reamed, not scraped. After overhaul, the engines are run in by belt, then lightly under their own power. Finally, they are transferred to a dynamometer where they are adjusted to prearranged standards.

Every twelve months each vehicle is automatically withdrawn from service. It is then stripped down completely and rebuilt. At this time improvements suggested by the research department, after having been approved, are embodied. The complete bus is rebuilt and repainted, then returned to the operating department, to all intents and purposes a new machine and in many respects a better one than the original design.

We have since 1907 operated nineteen different types of chassis produced by domestic and foreign manufacturers, also twelve different types of bodies, and we have tested nearly all suitable standard engines from four to eight cylinders, also many different types of radiators, clutches, transmissions, axles and chassis frames. In none of these instances did we meet with entire success. No doubt those who have control of the operation of heavy vehicle equipment will appreciate the many difficulties with which we were constantly confronted. Of course, our lack of standardization proves a severe handicap.

On looking back one cannot escape the conclusion that the design and production of our own equipment was the logical procedure to follow, particularly when one considers the extremely valuable data at our command as a result of experimental and development work plus the known results obtained from the operation of many different types. We certainly were in a unique position because we were able to select the best points from the numerous different types of vehicles operated by ourselves. Furthermore, it was not necessary to take precedent into account, nor to cater to other people's views. Then, again, we had no selling problems. The net result of our effort was the production of complete buses that have to date covered more than 20,000,000 miles. The performance of these vehicles has more than justified our fondest hopes. The enormous saving in gasoline and mechanical maintenance has been sufficient to meet the ever-rising costs of labor and material.

Gasoline is our second greatest item of expense. Our yearly bill is in round figures \$500,000. Since 1 per cent of this amount represents \$5,000 annually, it can readily

be seen that losses of even 1 or 2 per cent must be remedied, regardless of whether these losses are due to mechanical or physical disabilities. Increased labor and material expenses, and gasoline falls under the latter heading, cause us much greater anxiety than if we were manufacturing in the ordinary sense of the word, for we are selling a commodity which has a fixed price regardless of production costs. This means that every addition to our labor and material bills must be paralleled with some form of economy. If this were not done, we would soon find our expenses in excess of our income. For example, in 1911 our gasoline consumption averaged 2.9 miles per gal., to-day it is 6.5 miles per gal. At that time gasoline cost much less than it does to-day, and if it had not been possible to increase our gasoline efficiency enormously it is quite possible that the Fifth Avenue Coach Co. would now be out of existence. Not only is our gasoline bill the second greatest item of expense, but it is capable of greater reduction with less effort than any other single item. Furthermore, in achieving high averages, we accomplish at the same time many other desirable things. Our rising and falling gasoline averages are in effect the barometer on which we base our predictions. The gas barometer tells us in the most unmistakable language what is in store for us. Bad gasoline consumption means big fuel and repair bills with the prospect of still bigger bills in future; possibly also labor unrest due to general dissatisfaction.

Clearly, where car tracks do not already exist, the most careful thought should be given before they are installed. Quite apart from this, from a public service as well as an operating point of view, there can be no question as to the possibility of using buses for

1. Extending the service of existing car lines by a bus system into the outlying districts through the introduction of transfer privileges between the two.

2. Extending service, the conditions of the streets permitting, into outlying districts without a transfer between buses and the cars and without disturbing the present local business or business logical to the existing car lines by permitting the buses to operate beyond the present outlying terminus of street cars and diverting the buses to other parallel routes after reaching such outlying terminus.

There is one point I should like to make particularly clear. In my judgment, no type of bus designed up to the present is capable of properly handling peak loads. Of course, there are possibilities in regard to a suitable development along these lines, but as yet these have not been achieved.

Meeting the Combustion Requirements of Present Fuels

(Continued from page 1447)

Results to be attained by following the foregoing methods of vaporization are:

- (1) A better combustion with consequent decrease in fuel consumption
- (2) A decrease in crankcase dilution by limiting the passage of unburned fuel past the pistons
- (3) Reduction of carbon deposit
- (4) Maintenance of the engine in such a condition as to deliver higher power over longer periods between overhauls
- (5) Improvement of the general performance of the engine as to sweet running and ability to accelerate smoothly and rapidly

The committee notes a strong tendency at present toward making high volumetric efficiency secondary in importance to securing the best average performance with respect to power, economy, low maintenance cost and long service between cleaning the combustion chamber and spark-plugs. The most rational design is that which favors a

high torque and economy at speeds and loads usually found in service rather than a sacrifice of average performance for some special result desired only by a few or seldom demanded by the average user.

Committee

H. L. Horning, chairman
C. E. Broege F. C. Mock
P. C. Tice

Assisted by

Henry M. Crane J. H. Hunt
Dr. H. C. Dickinson W. A. Jacobs
H. C. Gibson W. S. James
G. H. Guernsey E. Planche
M. L. Heminway C. H. Short
F. E. Watts

LePere Vacuum Fuel Feed System for Airplanes

Investigations of this system, made at McCook Field by the Engineering Division of the Air Service, are applicable to motor car as well as to airplane practice, as the tests covered a wide range of value for both the amount of vacuum and the gravity head. The system described here is very similar to one in common use on automobiles.

AN idea of the capacities necessary for vacuum fuel feed systems may be gained from a series of tests made by the Airplane Engineering Division of the Bureau of Aircraft Production at McCook Field, Dayton, Ohio. The object of the tests was to determine the capacity of the vacuum tank used in the vacuum gasoline feed system of the LePere biplane.

Fairly high vacua are necessary in order to supply sufficient fuel for the Liberty "12" engine. With a lift of 3 ft., which is approximately that which obtains in the airplane, a vacuum of 4.0 in. of mercury is necessary to furnish sufficient gasoline for full power operation of the engine, while 6.6 in. are necessary to give the desired margin of safety of 100 per cent.

No data were available on the vacua which may be expected from the venturi tube on the airplane, but its ability to supply such high vacua as the above is considered very doubtful, except at the highest air speeds of the plane. This is borne out by the fact that the system did not operate satisfactorily in the very few flights during which it was used.

The gasoline supply system used on this airplane was of the vacuum feed type in which the vacuum, generated by a venturi tube placed in the air stream above the upper wing, was used to draw gasoline from the main supply tank in the fuselage to the gravity distributing tank in the upper wing. The system was built and installed by the Packard Motor Car Co.

The principal parts of this system are the main gasoline tank, the gravity distributing tank, which also contains the two vacuum chambers, and the air venturi tube. The main supply tank and venturi tube were not included in the test, as the information was desired on the vacuum chambers only.

As shown by the accompanying photograph, the gravity distributing tank is of streamline form and is arranged to be secured to the bottom of the upper wing. It is made of sheet steel and carries a level gage on one side and intake and discharge connections on the bottom. The two vacuum chambers are set into the top of this tank, as shown in the photograph, as is also a short stand pipe carrying at its top a filler cap. This extends through the top of the wing when the tank is in position on the airplane.

The vacuum chambers are very similar to those in the Stewart vacuum tanks, which are now in general use for automobiles. The diagram, Fig. 2, shows the internal mechanism of one of these chambers. Referring to the drawings, it will be seen that the vacuum chamber contains a float which actuates a vertical rod free to slide up and down in a sheet metal guide. By means of the linkage shown, the rod operates the vacuum valve *f* and the atmospheric valve *e*. This is accomplished by throwing the lever *c* up or down, as the case may be, and allowing the light springs on either side of the linkage to operate the valve. As

will be seen from the sketch, the springs are so arranged as to pull the lever *d* down when lever *c* is down, or to pull it up when *c* is in the up position. The operation of these tanks is as follows:

Being in the position shown in the sketch, the atmospheric relief valve is closed and the vacuum valve is open, allowing gasoline to be drawn into the vacuum chamber through the inlet connection at the top.

As the gasoline fills the chamber the float rises and throws lever *c* to its upward position. This closes the vacuum valve and opens the atmospheric relief valve, allowing the gasoline which has been drawn into the chamber to discharge by gravity through the check valves at the bottom into the gravity tank. When the gasoline drains out, the float pulls lever *c* down and the operation is repeated. From the gravity tank the gasoline is piped to the carbureters. Each vacuum chamber is a small sheet steel cylindrical tank, the top cover of which is an aluminum casting. All the valve and float mechanism is carried by this casting and is easily removable by unscrewing the small screws by which the cover is fastened to the top of the vacuum chamber. The linkage mechanism and valves are of brass, while the float is cork, heavily shellacked.

Both vacuum chambers carry a flange about two-thirds of the way from the top, by means of which they are screwed and soldered into the top of the gravity tank. The lower one-third of each chamber projects into the tank. The two gasoline intake connections are piped to a tee connection, from which a pipe extends down through the gravity tank for convenience in connecting to the pipe line from the main supply tank. The vacuum connections are at the top of each vacuum chamber, and in service these are piped to the throat of the air



Fig. 1—View of gravity tank with one vacuum chamber mechanism removed

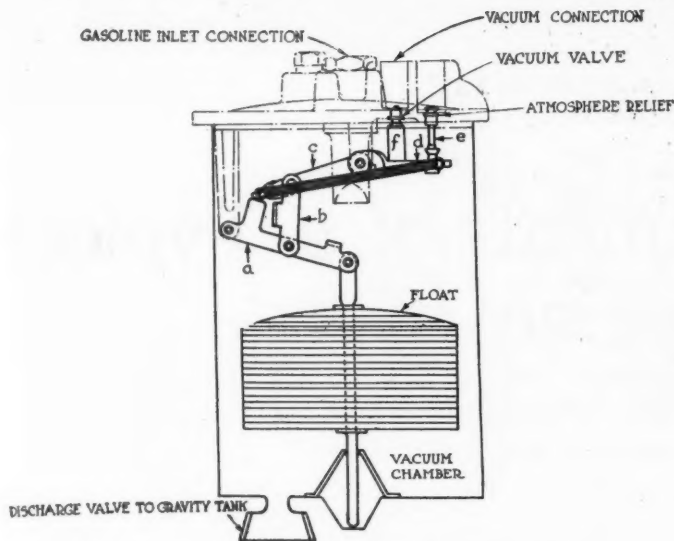


Fig. 2—LePere vacuum gasoline system

venturi just above the wing. The discharge connection from the gravity tank is at its lower point, from which the gasoline is led directly to the carbureters. Two steel supporting arms at each end of the gravity tank are provided for the purpose of attaching it to the upper wing panel. Each one of these arms is drilled with two bolt holes.

The drawing, Fig. 4, shows how the system was set up for the test. The gravity tank, with its vacuum chambers, was supported at either end by a wire cable which passed over a pulley, allowing the tank to be raised or lowered in order to change the lift. The main supply tank of the plane was represented by a small tank situated below the gravity tank. This was piped to the gasoline inlet connection of the gravity tank, as shown. The discharge connection from the gravity tank was piped to the weighing tank mounted on scales at the same level as the supply tank. For purposes of this test the vacuum was obtained by the use of a water venturi. The vacuum generated by this venturi could be accurately regulated by means of a valve in the water line. A mercury U tube was used to indicate the amount of vacuum in the line. The position of this U tube and the piping arrangement of the vacuum line are clearly shown in drawing.

Runs were made at lifts of 1, 2, 3, 4 and 6 ft., measured from the supply tank level to the inlet connection

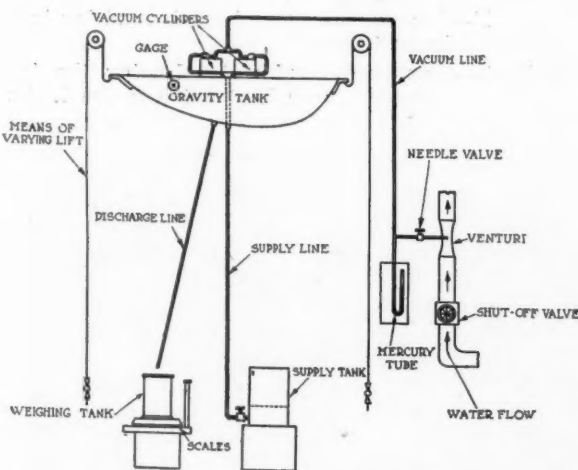


Fig. 4—Set up for test of LePere vacuum gasoline system

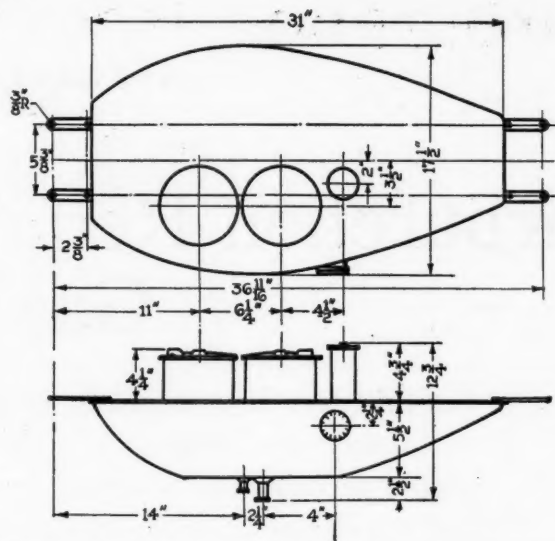


Fig. 3—Installation drawing LePere vacuum gasoline tank

of the chambers, and the vacuum at each lift was varied from $\frac{1}{2}$ to 10 in. of mercury, as shown in the accompanying tables of results. The method of procedure was to set the tank at the designated height and regulate the vacuum by means of the water valve. Holding the vacuum at the desired point, the time to discharge 6 lb. of gasoline into the weighing tank was observed by means of a stop watch, and from these data the discharge rate was computed.

The results of this test are given in the curves in Fig. 5. It will be noted that the curves are somewhat irregular and that the discharge does not bear a constant relation to the lift. This is undoubtedly due to the fact that the travel of the floats is not constant, the linkage mechanism, while sufficient for all practical purposes, being somewhat crude and loosely put together. It is also possible that the absence of synchronization of the two chambers may cause the erratic flow, a different amount of gasoline being drawn into the vacuum chambers when they are both drawing together than when they are operating alternately. Each point on the curves was checked by three separate observations, the average figure being taken as the value for the tables and curves. It was noted, however, that there was in every case a wide variation between the three runs at any given point.

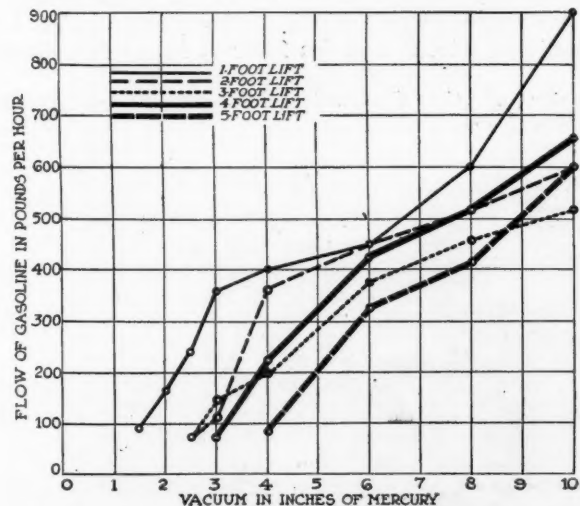


Fig. 5—Test of LePere vacuum gasoline system, curves showing capacity of vacuum chambers

Carburetion Requirements of a Typical Gas Engine

For this, Mr. Tice has taken a four-cylinder heavy duty engine and traced it through the laboratory. The article is a statement of characteristic engine performance resulting from the variations in mixture proportions and the degree of vaporization of the fuel in the intake system.

By P. S. Tice*

THE following material comprises a portion of the results obtained in an investigation of the mixture requirements of engines, carried on in the dynamometer laboratory of the Stewart-Warner Speedometer Corp., Chicago. The data here reported are a partial summary of work done with a Hinkley 4.5 x 5.5-in. four-cylinder, overhead valve, heavy duty engine. The compression ratio in this engine is 3.8:1.

The purpose of the general program, of which this work forms a part, is twofold: (1) a direct experimental determination of the mixture proportion requirements of engines for the development of maximum power and for the development of minimum specific fuel consumption; and (2), a determination of the effects upon the requirements and upon the performance of varying degrees of fuel vaporization in the intake system.

This report has primarily to do with the performance and requirements with two methods of treatment of the charge after it leaves the carburetor, and, since one of these methods was incapable of handling the heavy fuels, the whole work was done with the one fuel—Red Crown gasoline, as purchased in Chicago in January of this year. Furthermore, the same carburetor, Fig. 1, was employed throughout, so that no differences in performance or requirement are attributable to differences in fuel division or to differences in air flow characteristic in carburetor.

The two vaporization methods used were the typical hot-spot manifold, Fig. 2, and the Stewart heavy fuel system

(SHFS), Fig. 3. These views make clear the intake setups in the two cases. The runs of Fig. 4 were made before starting on the body of the work, so that possible differences in the performance characteristics with the two methods of vaporization, at open throttle, could be properly accounted for in summing up the results.

The Observations.—The two set variables throughout the investigation were the engine speed and the load, as represented by the absolute value of the intake manifold pressure, measured at its outlet. At each set combination of speed and load, the mixture proportions were varied from approximately the poorest in fuel with which steady firing could be obtained, to one so rich in fuel as to result in an appreciable loss of output. The spark timing was in all cases adjusted to that position giving the then maximum torque. In each run observations were made of the following variable quantities:

- A—Air in lb./sec.;
- F—Fuel in lb./sec.;
- Q—Torque in lb. at 63 inch radius;
- H—Barometric column in mm. of mercury;
- Δh —Fuel metering head in carburetor in mm. of water;
- t —Temperature of air entering the carburetor, deg. F.;
- t_m —Temperature of mixture entering the cylinders, deg. F.; and
- X—Angular advance of spark resulting in maximum torque

The quantity t_w —Temperature of water leaving the jacket, deg. F., was kept between the limits of

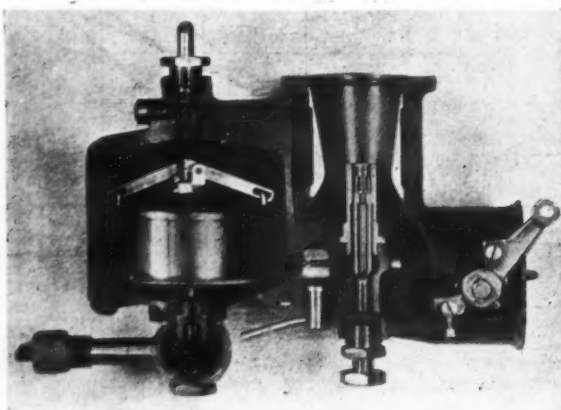


Fig. 1—Carburetor of the Stewart Heavy Fuel System, with unobstructed outlet and provision for vaporization of the liquid

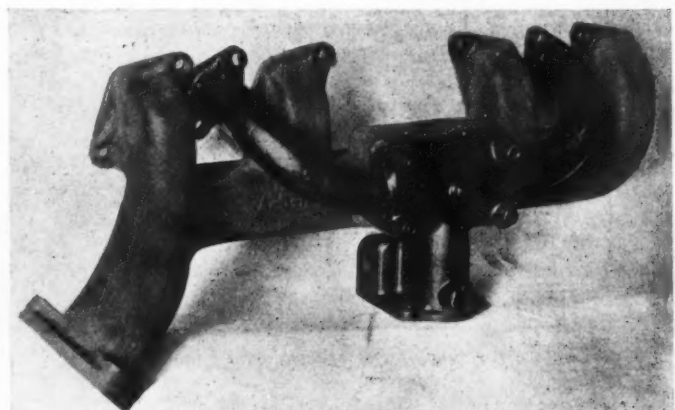


Fig. 2—The hot-spot intake manifold used in the investigation. This is an exceptionally well worked out manifold of its class

*Director of the Carburetor Division, Stewart-Warner Speedometer Corp.

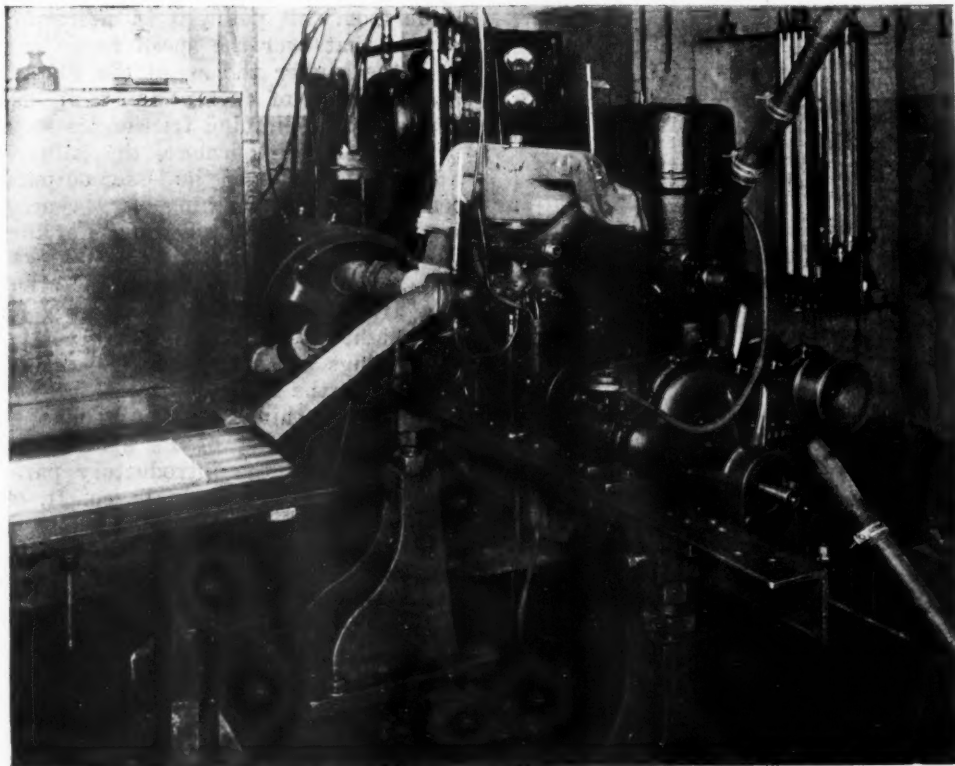


Fig. 3—The Hinkley engine and Stewart Heavy Fuel System, as set up for the work here discussed. The set-up of the hot-spot duplicated this exactly

165 and 170 deg. F., except where noted; and the quantities

N —engine r/m; and

H_s —Absolute pressure in the intake manifold, in mm. of mercury, were arbitrarily set to include the range 400 to 1200 in the case of N ; and the range from minimum possible to approximately the maximum possible in the case of H_s .

From the observations, the following quantities were computed for use in the plottings, or for use in arriving at the plotted quantities:

P_b —Brake mean effective pressure, lb./sq. in. = $2.265 Q$;
BHP—Brake horsepower = $NQ/1000$;

f_b —Brake specific consumption, lb./BHP-hr. = $3600 F/BHP$;

R —Ratio of air to fuel in the mixture = A/F ;

D_s —Density of air in the mixture, lb./cu. ft. = $592.8 A/N$;

(vH_s) —Partial pressure of fuel vapor in the mixture, mm. of mercury = $H_s - D_s T_s / 0.05206$;

T_s —Absolute temperature of the mixture, deg. F. = $460 + t_s$;

E_{bt} —Brake thermal efficiency = $.14139/f_b$; and

E_v —Volumetric efficiency = $11372 AT/HN$.

Effects of Mixture Ratio.—For the purpose of fully describing the effect upon the performance of various mixture ratios, separate plottings for each speed were made of f_b against R and of P_b against R . These graphs are shown in Figs. 5 and 6, respectively. The inverted peaks of such a set of curves as Fig. 5 give directly the ratios of air to fuel resulting in minimum specific fuel consumption, while a group as in Fig. 6 give the R values resulting in maximum output.

From such sets of curves, the points of Figs. 7 and 8 are taken. It will be noted that, while there is a marked similarity in these two plottings, there are also interesting differences. In the case of the hot-spot manifold, the speed range included is, unfortunately, not so great by 200

made with the hot-spot. Thus, Fig. 7 is not nearly so complete as its companion.

The notable differences in these two diagrams are the generally leaner mixtures in the range for minimum fuel consumption in Fig. 8 and the interesting and consistent crossing of the curves in Fig. 8 for the range of mixtures giving greatest output. Just why these curves should cross, while the corresponding ones in Fig. 7 show no marked tendency to do so, is open to question. However, a possible explanation of the raising of the low pressure ends with increased speed is found farther on in the discussion of partial pressures of fuel vapor in the charge. In any case, the obvious thing about these figures is the relatively constant and low value of the ratios for maximum output, compared with those for minimum consumption.

The Condition of Maximum Output.—Other things being equal, the mean working pressure is a direct function of the amount of heat liberated within the cylinder. Since the upper limit of the

amount of heat that can be evolved in a cylinder is limited solely by the amount of oxygen present, with a given fuel, it follows that this evolution of heat will attain its maximum only when there is sufficient fuel to insure that none of the oxygen shall escape combination. For this reason, greatest possible output is attained only when fuel is present in excess of its true combining proportion. Likewise, greatest economy is had only when the least possible amount of fuel escapes combination. That is to say, when an excess of oxygen is present.

It is notable in Fig. 8 how fairly the curves for minimum consumption include the points obtained with the

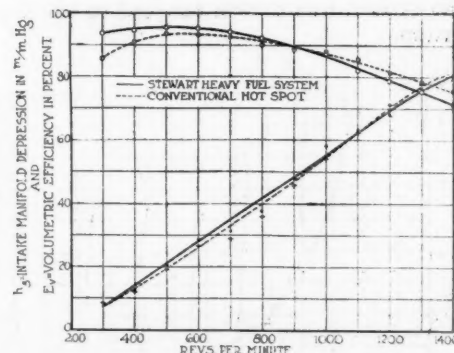


Fig. 4—Comparison of the volumetric efficiencies of the Hinkley engine with the two intake systems employed

motor idling. These latter points are expressions of ratios of maximum output, since with these ratios the engine was idled at the speeds in question with the minimum possible manifold pressure, i.e., with the least possible quantity of working fluid.

This point checks perfectly with similar data developed by the writer from tests of a high-compression aeronautic engine*; but owing to the lower compression ratio in the present case, the forms of the curves and their posi-

*Report 49, of the Fourth Annual Report of the National

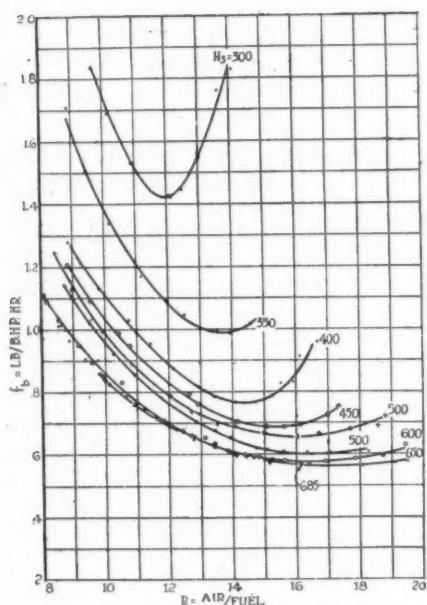


Fig. 5—How the fuel consumption varies with the mixture ratio, over the load range

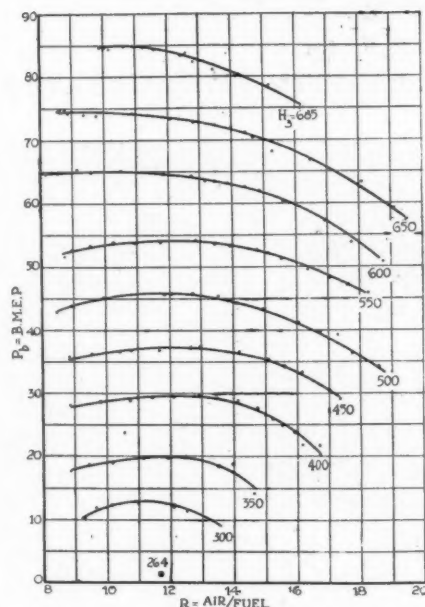
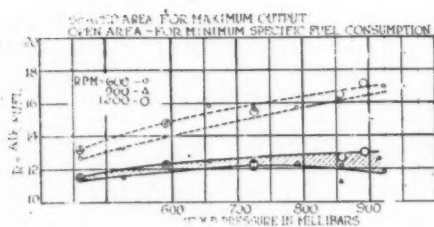
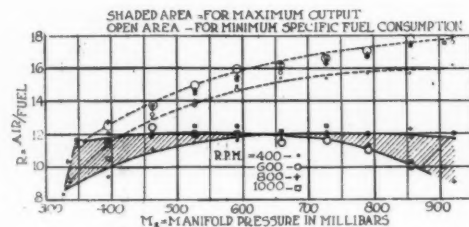


Fig. 6—Effect of mixture ratio on output, with various degrees of throttling



Figs. 7 and 8—Mixture ratio requirements for the development of maximum output and minimum specific fuel consumption. These curves describe the general order of variation in fuel metering that should be accomplished by the carburetor



tions on the ratio scale are both modified from that case.

Fuel Utilization.—A useful plotting, as in Fig. 9, has been developed in the execution of this work. Here we have a direct expression of the relationship of brake specific consumption to mean cylinder pressure, as modified by the mixture ratio and the charging pressure. The chief usefulness of such a plotting is that it permits a true statement of the maximum fuel utilization obtainable under the conditions of test. This is shown in Fig. 9 by the broken line drawn tangent to the several curves of the group.

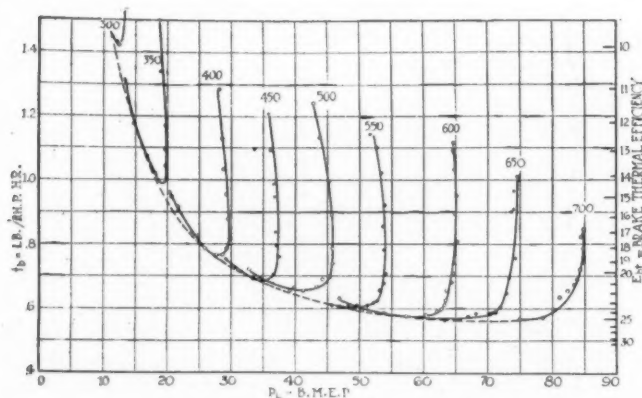


Fig. 9—A representative fuel utilization graph—a simple picture of the cost of high power

this explanation might seem to fit the case of the hot-spot, were its results standing alone.

The true explanation is undoubtedly bound up in the abnormal thermal conditions resulting from the then excess of fuel in the mixture.

Vapor Content of the Charge.—The differences in both requirement and performance that have been turned up in the foregoing have their origin, it seems, in the results plotted in Figs. 12, 13 and 14, particularly with respect to the partial pressure of the vapor in the charge. The differences $t_s - t$, in the two cases, are too small to account for

Two sets of these maximum utilization curves are brought together in Fig. 10 and thus serve as a very definite bit of evidence that conventional vaporization methods leave something to be desired. Aside from this point, it is interesting to note that over the speed range covered, the higher the speed the greater the utilization of fuel, and this in face of the rapidly climbing friction losses in the engine. Furthermore, the gain is, in general, greater at the lesser outputs. Here we have something very conclusive, it seems, on the advantages of turbulence in the charge.

Since the possible maximum output of a given engine depends solely upon the weight of oxygen it can draw in, other things being equal, it is interesting to note the effect of modifying one of the other things. This is done in Fig. 11, a plotting of P_b against D_s , D_s , as noted in the introductory paragraphs, is the density in lb./cu. ft. of air in the charge, and is, therefore, a fundamental unit describing the oxygen content of the mixture.

In the case of Fig. 11, it is noted for the hot-spot manifold that higher speeds are conducive to gain all along the line and serve to straighten the curve. As distinguished from this result, it is noted for the SHFS that the lines of constant speed cross each other with fair consistency. The low speeds have the advantage at small densities, while the higher speeds have it at the greater densities. This is not explainable on the ground of varying turbulence, however well

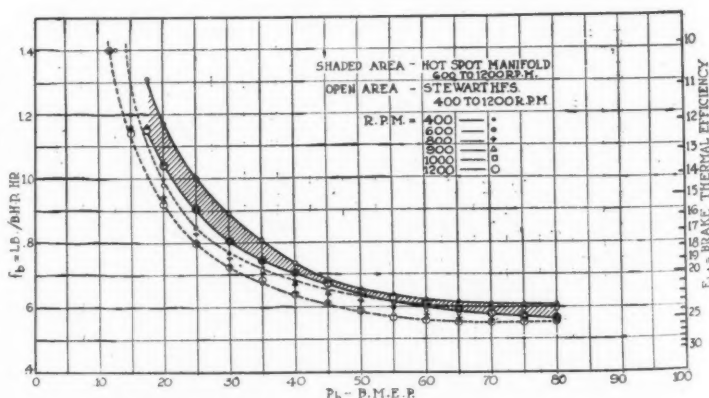


Fig. 10—A direct comparison of the maximum fuel utilizations possible with the two carburetion methods examined

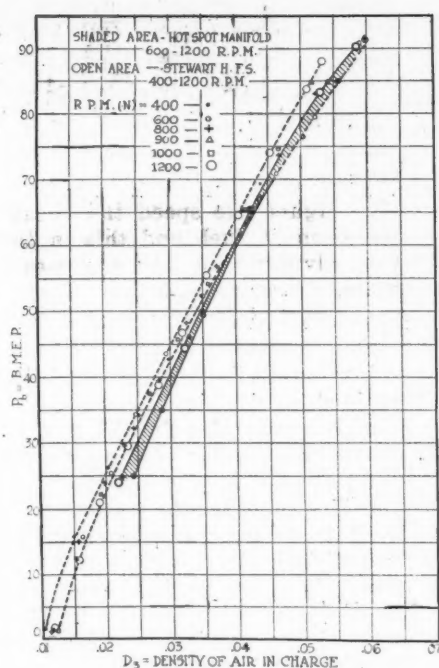


Fig. 11—How a change in the vapor content of the charge modifies the possible output

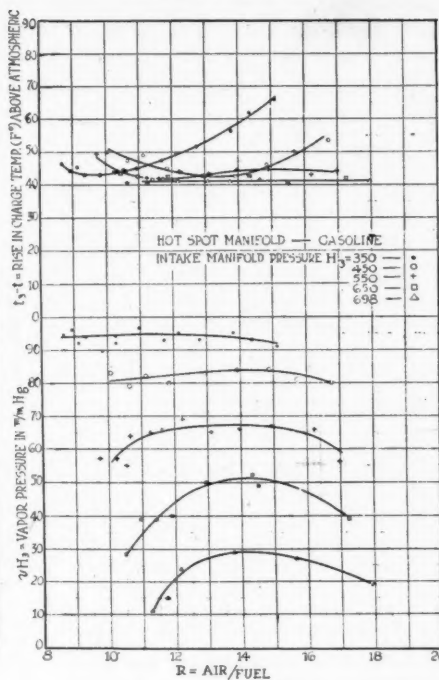
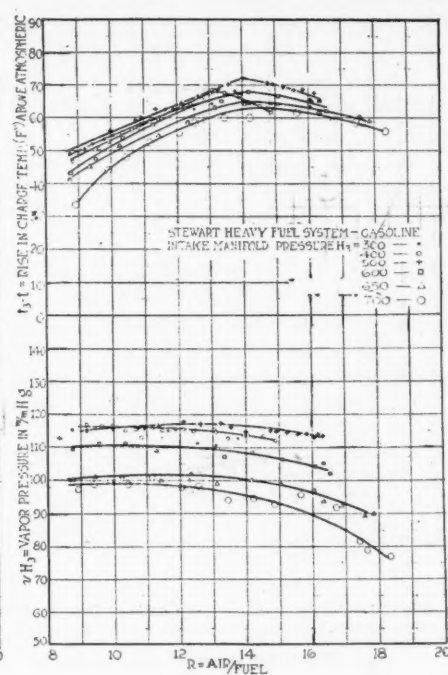


Fig. 12 and Fig. 13—Charge temperatures and vapor pressures. The values of the latter are direct measures of the relative vaporization of the fuel



much in themselves, though their very different characteristics are interesting.

With the hot-spot manifold, Fig. 12, both the fuel and the air are subjected to direct heating. This shows plainly in the curves for the lower manifold pressures, where each decrement of fuel content accounts for an increasingly sharp rise in temperature. At higher manifold pressures, the increasing quantity of air sweeping the heated surface controls the charge temperature more nearly independently of the fuel content. Thus, a lower temperature results, but very much at the expense of the relative vapor content of the charge.

The $t_s - t$ curves of Fig. 13 are all of the same characteristic form and are but little displaced from each other. In other words, the same factors retain control throughout. The hump in each is the result of the method of charge formation, which is that of condensation of the fuel vapor in the otherwise unheated air stream with which it is to mix.

Control of Charge Temperature.—Following the course of any one of these $t_s - t$ curves, from right to left, it is seen that, as more fuel vapor is caused to mix with the air, the temperature rises, because more heat reappears as sensible heat upon condensation of the vapor. In this vaporization method, the fuel spray entering the vaporizing chamber is swept by the outgoing vapor, so that heat is transferred from the latter to the former directly. This controls the temperature of the vapor and prevents it from having superheat when it contacts with the air. But, with a largely increased rate of fuel supply to the vaporizer, the initial superheating of the vapor formed in it will be less because of the greater rate of evaporation of fuel per unit of

surface, and the consequently lower temperature of that surface. The heat supply to the vaporizer remains substantially constant along any one of the $t_s - t$ curves under discussion.

The net result is that as the rate of fuel supply is increased beyond a definite value, the vapor condenses, in part, in the presence of the spray globules, and before it comes into contact with the air. Thus, less and less heat is given up to the air to raise its temperature, as the fuel supply is further increased.

Hot-Spot Vaporization Rate.—Turning now to the vapor pressure curves of Figs. 12 and 13, it is seen that, here also, the characteristics are quite different. In the hot-spot, the vapor content of the charge declines rapidly with rise of manifold pressure. Also, at all but the smallest manifold pressures used, the vapor pressure, starting at the peak of the curve, falls as the fuel content is increased, showing conclusively how much the vaporization

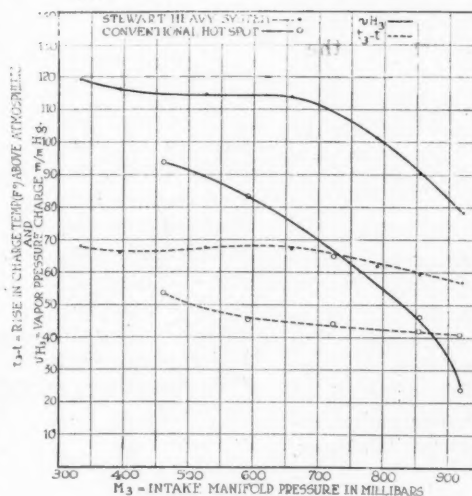


Fig. 14—A direct comparison, at maximum fuel utilization, of the extent to which vaporization is carried in the two methods

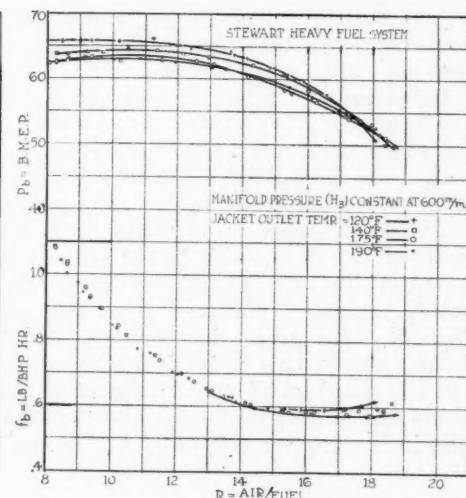


Fig. 15—The influence of jacket water temperature upon performance at approximately three-quarter load

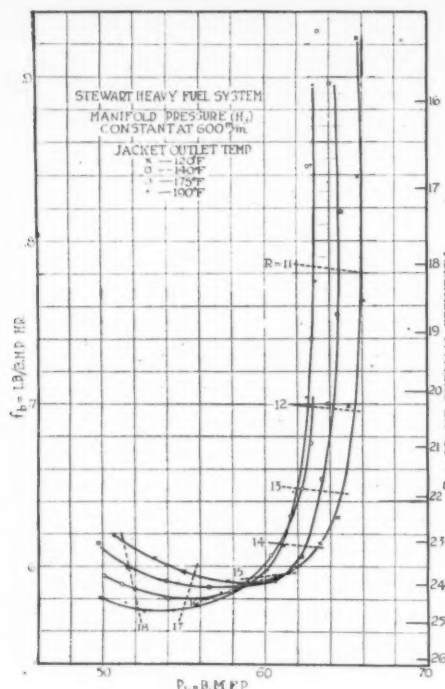


Fig. 16

Fig. 16—Jacket water temperature is here seen to be a controlling factor in carburetion requirement, even in the case where it has an almost negligible effect on the quantity of the mixture

Fig. 17—Why possible utilization of fuel falls off so rapidly with throttling

rate suffers as the wetting of the walls increases. Passing from the peak to a lesser fuel content, it is shown how the air removes so much heat that the vapor content again suffers rapid decline.

In the case of the hot-spot manifold, in which vaporization is progressing throughout its entire length under all conditions, an indeterminate and by no means constant error exists in the observation of charge temperature, t_c . This follows from the fact that the readings are "wet bulb" ones, fuel being evaporated from the thermometric means. This results in a too low value for the t_c observations; and, as seen from the form of the expression for (vH_s) , gives a too high value to this latter quantity. In the case of the SHFS, this condition does not exist, since the charge is formed by condensation of the fuel vapor in the central mixing chamber of the manifold. Thus, both the air of the charge and the fuel fog particles mixed with it have the same temperature, and the (vH_s) values may be taken as the true ones.

Since the fuel used in this work was the same in both cases, it is evident that complete evaporation, or complete saturation, was not attained by the hot-spot at any point. The relative performances in this respect are clearly shown in Fig. 14. Here it is seen that there is a direct and consistent relationship between vapor pressure and charge temperature in the case of the SHFS, which relationship does not exist in the hot-spot.

Influence of Jacket Temperature.—It is purposed to end this summary with a bit of representative data on the effect of jacket water temperature. This work was done with the SHFS only, since it was desired to alter only the one condition, in so far as possible.

Groups of runs were made, including the foregoing range of R values, with jacket outlet temperatures maintained at 120, 149, 175 and 190 deg. F. respectively. The P_b and f_b against R plottings from this work are shown in Fig. 15. This graph does not need much comment. The obvious conclusions to be drawn from it are that the specific consumption of fuel is almost negligibly affected, at all but the leanest mixtures; and that the cooler jacket results in the greater output, at all but the leanest mixtures.

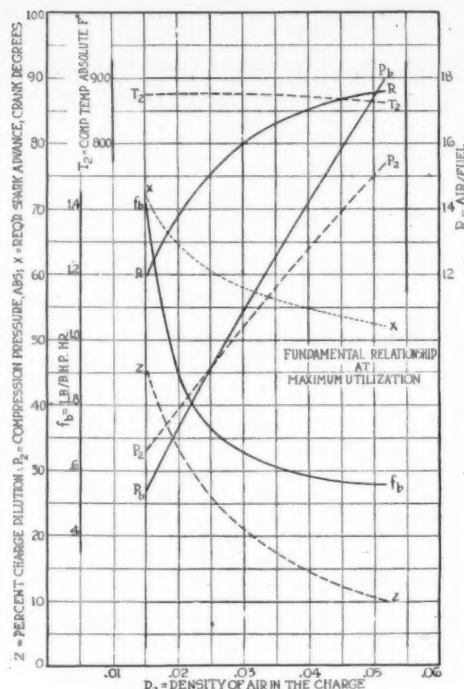


Fig. 17

and 0.572, a saving in specific cost of 39.8 per cent.

There is one thing more that should be mentioned, apropos of Fig. 10. This graph is an expression of the maximum utilization of which the engine in the case is capable, considering its carburetion method. It is obviously impossible to have an engine operate flexibly and snappily under rapid throttle manipulation if its carbureting system is set to hew the lines there laid down. But the fact remains self-evident that the flexibility of an engine is in direct relation to the vapor content of the mixture supplied it; and the higher that vapor content, up to saturation, the more economical can be its performance, without sacrifice of flexibility under throttle.

Conclusions.—The general conclusions deducible from the foregoing seem to be:

- (1) Relative engine speed has little effect on fuel utilization, working cylinder pressures and carburetion requirements.
- (2) Relative load on the engine is the dominant controlling factor at all points.
- (3) Both the utilization of fuel and the specific working pressures are direct functions of the relative vapor content of the charge.
- (4) Jacket water temperature exercises a direct control upon fuel utilization with respect to carburetion requirements, independently of its possible effect upon initial mixture quality.

In further elaboration of item (2) above, attention is directed to Fig. 17, in which are plotted corresponding values of the fundamental controlling factors and their performance results. In general, the rate at which heat is evolved in the combustion of a charge varies with its initial temperature and pressure. Under the conditions that obtained in the present work, the effect of bad temperature of compression may be neglected because of its constancy, having due regard for the effect of its position on the temperature scale. This leaves the compression pressure P_2 as the prime variable,* and, considering it alone, it is

$$*P_2 = P_1 \frac{v_{2,3}}{v_1}$$

A somewhat different aspect is put upon the case, however, when the same points are plotted as in Fig. 16. The significant thing about this graph is the reversal of relationships at a common point. On this evidence, if the carbureter is set to deliver a mixture having a ratio of air to fuel of 15.8, clearly the jacket water can be run at any temperature desired, within the limits of the test, with no change in either output or fuel consumption. If the mixture is richer in fuel than 1/15.8, there is every advantage in keeping the jacket relatively cold. A hot jacket imposes a mixture of greater ratio than 15.8, if fuel waste is to be avoided.

This graph also furnishes a very convincing picture of the price that must be paid in possible engine output if everything is worked to the limit to secure the greatest utilization of fuel. In this plotting a maximum P_b of 66 lb. is shown. That at minimum f_b is 53 lb., or 80.4 per cent of the maximum. The corresponding fuel consumptions are 0.800

evident that the rate of combustion, and therefore of heat evolution, will vary with it if the relative fuel content of the charge is small and constant.† Since the relative utilization of fuel depends in great measure upon the rate at which its energy is liberated, as well as upon the amount of energy liberated, it is seen that, to maintain the most advantageous relationship between the rate of heat evolution and the amount of heat evolved, it becomes necessary to enrich the mixture somewhat as its pressure is reduced. This accounts, in itself, for the requirement for richer mixtures with throttling.

Charge Dilution.—But superimposed upon this is another condition which further increases the required enrichment. As the throttling is increased, the density of the charge is reduced, and the relative amount of inert products of combustion remaining in the cylinder to dilute the new charge increases very rapidly. This is shown in curve Z, Fig. 17, computed from the data of the test. Considering the known effects of dilution of a charge with non-combining gases,** the form of the R curve may be

†See Plot No. 22, Part V, Report 49, of Fourth Annual Report of the National Advisory Committee for Aeronautics, based on experiments by Bairstow and Alexander, Proc. Royal Soc. (Brit.), 1905.

**See Plot No. 23, Part V, Report 49, of Fourth Annual Report of the National Advisory Committee for Aeronautics, based on U. S. Bureau of Mines Tech. Papers Nos. 43 and 121.

taken to be completely explained on the basis of the curves P_2 and Z.

Since we are dealing with a varying rate of heat evolution, it is evident that the working pressures attained will be functional with the time of ignition, and that it will be required to vary with the throttling. Having this latter at all times most advantageously located—curve X, Fig. 17—it is noted that the working pressures curve (P_b abs.)†† has a much greater slope than has the compression curve (P_2 abs.) This is a very significant relationship, as showing how we unavoidably lose out with respect to P_b , largely because of charge dilution, in spite of the relatively greater energy made available through mixture enrichment.

Furthermore, since fuel utilization varies directly as the mean working pressure, and inversely as the relative fuel content of the charge, the best net result in utilization, curve f_b , Fig. 17, is one which proves that it is hardly justifiable to operate an engine in its normal service at much under one-half its possible output.

††For the purpose of the present discussion it is thought best to confine attention to brake results, with respect to both f and P , since it is with these quantities that we are practically concerned. In any case, substituting the indicated value (P_i) for that given would not materially modify the relationships, since the friction value (P_f) is not a constant and varies in such manner as to further increase the slope of the curve.

New Truck Axle Has Planetary Final Reductions

A TRUCK axle embodying a new form of final drive has been developed by the Flint Motor Axle Co. It is the intention to manufacture this axle for trucks in capacities from one ton up, and the 1-1½ ton capacity truck axle will be put in production first.

As may be seen by reference to the sectional illustration, there is a first reduction of the transmission speed by bevel gears at the center of the axle and a final reduction by a set of planetary gears at the ends of the axle. Therefore, the torque transmitted by the differential and axle shafts is comparatively small and it is not necessary to build the axle as heavily as would otherwise be necessary. The reduction at the bevel gears is only 2.14 to 1, hence the torque on each axle shaft is only slightly more than that on the propeller shaft. Bevel gear drive and differential are of conventional construction.

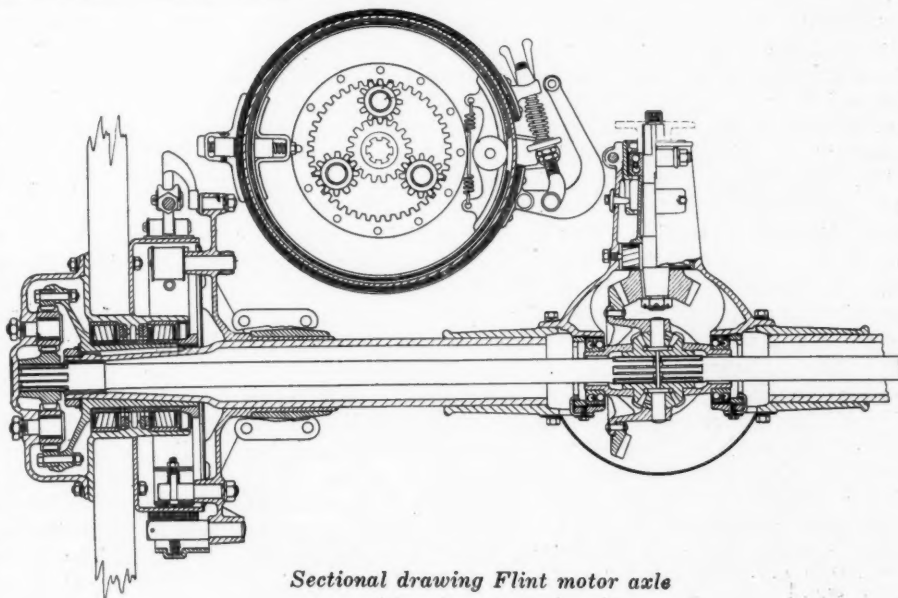
To the end of the axle shaft is secured, by means of a splined fitting, a spur pinion meshing with three equally spaced planetary pinions carried on studs secured into a housing that is bolted to the outside of the driving wheel hub. These planetary pinions also mesh with an internal gear ring, which is keyed to the end of the axle tube. One advantage of this form of transmission is that it gives a high road clearance at the center of the axle, while at the same time it permits of enclosing all members of the transmission and operating them in oil.

The axle here illustrated has a thread of 56 in. and a carrying capacity of 3800 lb. on the spring seats. The latter are normally spaced with 39 in. centers for 2½ in. width, ⅝

in. clips, but spring centers can be varied from 38 to 40 in.

Total gear reductions of from 7⅓ to 8.8 can be obtained, the bevel gear ratio being varied from 2.14 to 2.647, whereas the planetary gear ratio remains constant at 3.33. The bevel gears are of 5 diametral pitch with 1¼ in. face and the planetary gears of 6-8 diametral pitch by ¾ in. face.

The brake drums are 14 in. in diameter by 2½ in. face, and external and internal brakes act on the same drums. Hyatt roller bearings are fitted in the wheel hubs and directly back of the pinion on the pinion shaft, while New Departure ball bearings are fitted at the outer end of the pinion shaft and on the differential. The axle shafts are made from chrome nickel steel, splined at both ends and heat treated.



Sectional drawing Flint motor axle

Accuracy Essential Feature of Crankshaft Manufacture

Interesting methods to secure the utmost accuracy in the manufacture of crankshafts have been worked out by a Middle Western concern. Investigation has proved that proper alignment of the crankcase lengthens the life of the bearings. The methods in use at this plant are described.

By J. Edward Schipper

EXPERIENCED engine manufacturers know that of all the parts of an engine the crankcase requires the greatest degree of accuracy. Manufacturers of engines for passenger cars have thoroughly realized this and the result is that there have been some very interesting methods worked out in order to secure the utmost in this respect. One of the concerns which has made a particular study and devised some original means for maintaining accuracy in this important engine part is the National company of Indianapolis, Ind. This concern manufactures a very high-powered, overhead valve, six-cylinder car and makes its own engines. Crankcase manufacture has been made a matter of special study, and the methods described herewith are in use.

It has been found that proper alignment of the crankcase not only insures increased bearing life, but also has much to do with the performance of the clutch and gearset, inasmuch as they must be accurately aligned with the crankshaft in order to function at their best. Care commences immediately upon the receipt of the raw castings. These are checked by inspectors for cracks, etc., and are weighed with a variation limit to insure uniformity. After the preliminary inspection is passed, all these castings are sand-blasted to loosen all the core sand which adheres to them and they are washed in Oakite, an alkaline solution. The crankcase castings are dipped into this boiling solution and then rinsed in hot water. All of this is preliminary to the first manufacturing steps and is done to insure a clean product before the casting ever gets to a machine.

The first manufacturing step is a rough milling operation on the bottom of the case and on the bearing cap faces. For this operation the work is located from the surface of the flange and from the surface of the supporting arms on the casting. This is a three-point suspension operation, the casting first being located by a screw locating point and then by spring plungers which support the rest of the casting while the milling operation is going on. The machine used is a Becker vertical miller, and it takes off about $\frac{1}{4}$ in. stock on this rough milling operation.

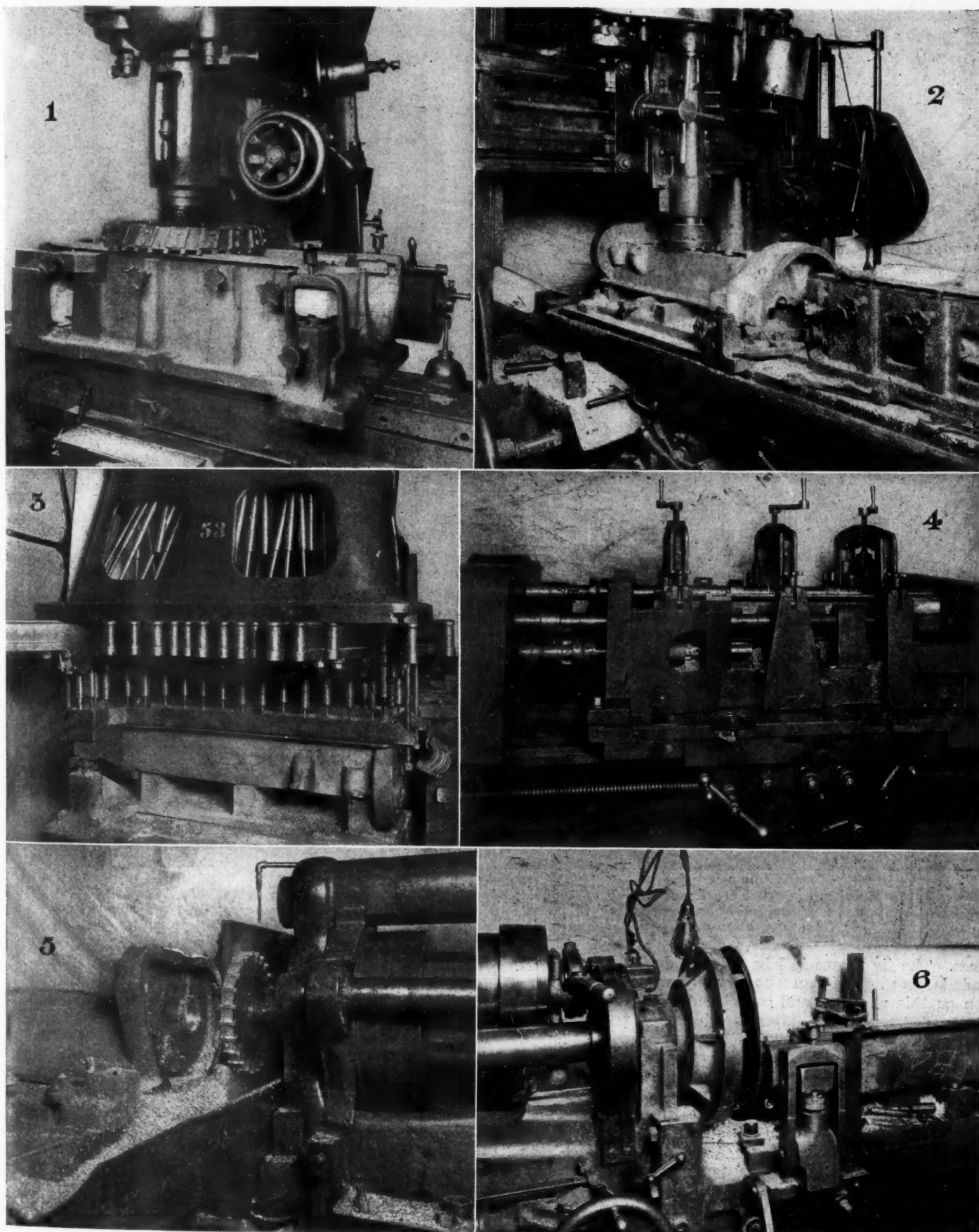
The first rough milling operation on the bottom of the crankcase gives a surface from which to locate the other milling operations. These are conducted on a Beeman & Smith planer type miller with a long table enabling work on two crankcases to be carried on practically simultaneously; that is, while one is being milled the other is being set up. This second operation is to rough mill the top of the case, the location being from the rough milled bottom face. After this rough milling is completed, the casting is set aside for a week to cure before the finish milling operations are completed. The same Beeman & Smith machine is used for doing the finish milling, the jig being

so arranged and the table and tools so set, that either side may be turned up and either rough milling or finish milling accomplished. Not only are the top and bottom of the crankcase finish milled on this machine, but also the bearing cap surface. The timing inspection boss on the flywheel housing is also milled on this machine, which holds the work in place by means of spring plungers and locates it from the bottom surface of the crankcase.

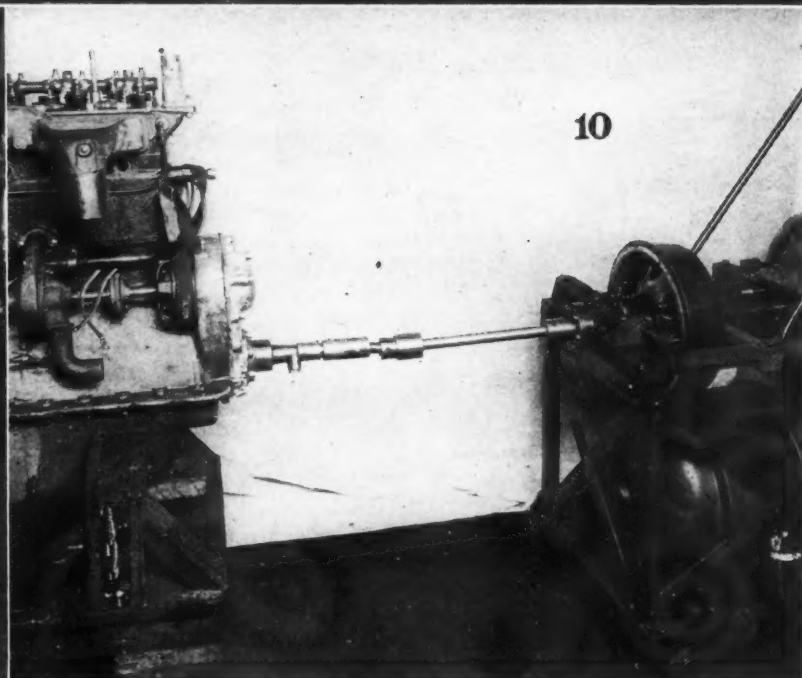
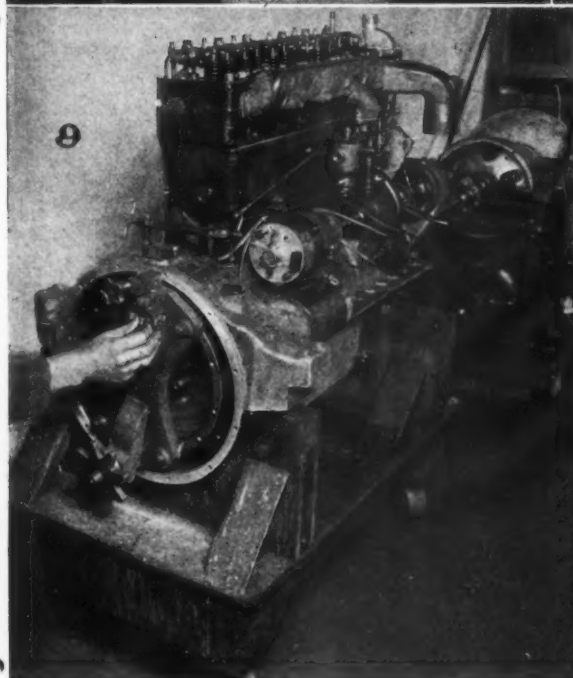
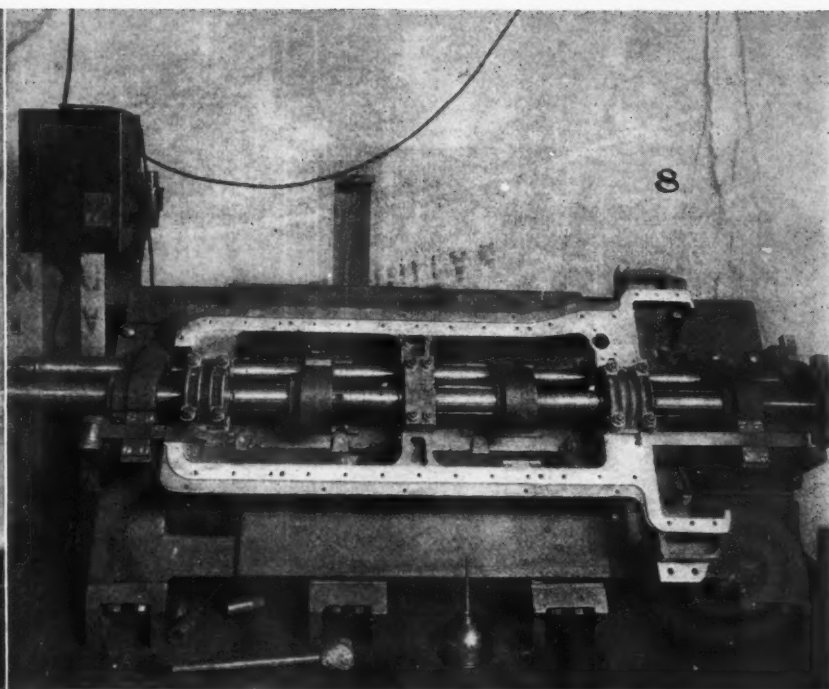
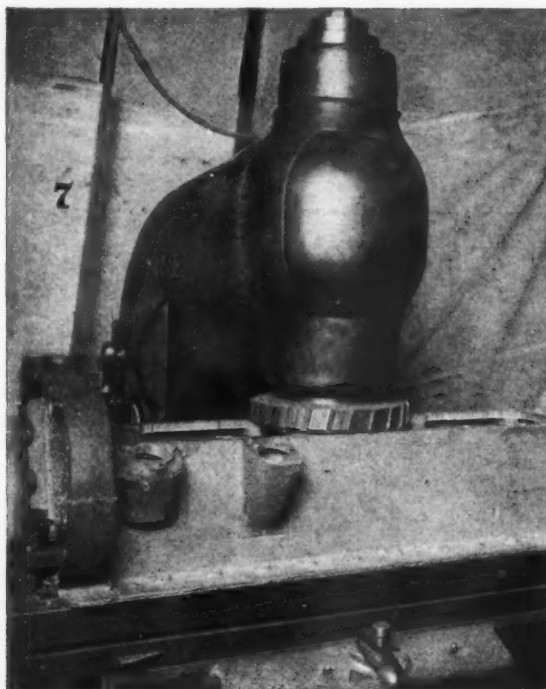
Following the rough and finish milling, all the holes for the oil pan cap screws are drilled simultaneously on a multiple spindle drill. Two dowel holes are also drilled at the same time, these matching holes in the oil pan so as to give interchangeability of crankcases and oil pans. It will be seen subsequently that, although a crankcase and oil pan are machined together in some of the operations, it is not necessary that the same oil pan be assembled to the finished crankcase, as the dowel holes and surfaces are accurately manufactured to give absolute interchangeability. The drill utilized operates forty-three spindles simultaneously and is a Natco multiple spindle unit. Outside of the multiple spindle drilling operation there are some individual holes, such as those for the cylinder hold-down bolts which are drilled singly. These are all jig operations, but are accomplished on a single machine, as they do not lend themselves readily to the use of a multiple spindle unit.

One of the most interesting operations is the following, which primarily locates the main and crankshaft bearings. The caps are assembled to the bearing and the cases bored for the crankshaft, camshaft and waterpump drive-shaft bearings. The work is done on a remade lathe, the machine really being a special design of the National company and arranged to bore, flycut and ream all the bearings and to space the center main bearing. The flycutting operation is accomplished on a single pointed tool which, because of its requiring but a single setting and doing all the work, is more certain to maintain roundness than a multi-pointed tool. This insures alignment of the main and camshaft bearings.

It is, of course, essential, in order to maintain the roundness desired, that the crankcase be not sprung in any way by the boring operations, and to guard against this an exceptionally rigid, heavy jig is utilized. This is shown in Fig. 4. This jig weighs over 2000 lb., but is so balanced that it can be readily slid around the surface plate upon which it is mounted, with one hand. As the jig completely surrounds and reinforces the crankcase, there is no opportunity for spring during the cutting of the bearing, and this in combination with the flycutting method has been found to give extreme accuracy of alignment and roundness in the location of these bearing sur-



(1) Rough milling bottom of National crankcase on Becker vertical miller. (2) Rough milling top of crankcase and finish milling operation on Beeman & Smith machine. (3) Drilling holes for oil pan cap screws on multiple-spindle drill. (4) Boring, flycutting and reaming bearings on a special remade lathe and with a 2000-lb. jig. (5) Milling timing gear face on a Natco machine. (6) Boring and facing flywheel housing, leaving $\frac{1}{8}$ in. material for aligning



(7) Final milling and crankcase taking off .005 in. of material from the cylinder pad. (8) Lined reaming bearings on fixture with bronze bushing in place. (9) Tool bolted to flywheel to face off flywheel housing. (10) Same operation as Fig. 9, showing method of driving crankshaft through clutch from motor

faces. The jig shown in Fig. 4 is the design of, and was made largely by the man who now superintends the operation on this machine, and consequently unusually careful workmanship results. After the flycutting operation, all of the cylinder hold-down bolt holes are drilled and tapped, and the center main bearing bolt holes are counter-bored. These operations are accomplished on a Hammond radial taper.

In milling the timing gearcase face, an operation which is illustrated in Fig. 5, location is secured from the dowel holes which were drilled and reamed on the Natco, the operation shown in Fig. 3. The timing gear milling operation is accomplished on a Becker miller. The opposite end of the crankcase, or the flywheel housing, is milled after the caps are disassembled and the oil pan assembled to the

case. The flywheel housing is bored and faced, 1/16 in. stock being left on the bore and on the face of the flywheel housing to take care of alignment. This 1/16 in. is removed, as will be afterward described, as a final operation before assembly to the clutch and gearset. The tool utilized for turning and boring the flywheel face on this primary operation is a Vinsse, and the location is from the milled face of the center bearing and from the bored and reamed crankshaft bearing holes; that is, the holes which were previously flycut. This gives a primary alignment of the flywheel housing in connection with squareness to the axis of the crankshaft, due to this method of location.

As a final milling operation on the crankcase, 0.005 in. is taken off the cylinder pad face to be sure it is flat.

Production Methods in the British Automobile Plants

Despite schedules for larger outputs, the English factories generally continue pre-war methods of machining and assembling. There is, however, greater accuracy in manufacture and greater tolerance where narrow limits are unnecessary, as, for instance, in external finish.

By M. W. Bourdon

IN making an official announcement recently, on behalf of the Society of Motor Manufacturers, Frank Lanchester, the president of the Society, pointed out that while the cost of labor and material in England are now $2\frac{1}{2}$ times greater than they were in 1914, the average increase in the prices of complete cars is less than 100 per cent. The reason why prices had not soared equally with costs was stated by Mr. Lanchester to be the use of "greatly improved machinery and methods of manufacture, and the increased outputs resulting therefrom."

By what process of accounting, the present-day prices of British cars can be said to represent an increase of "less than 100 per cent," the writer cannot say, for taking haphazard half a dozen well-known pre-war models as examples, their prices show increases quite in keeping with the increase in costs of labor and materials. But aside from this question of costs and prices the adoption of "greatly improved machinery and methods of manufacture" is open to question.

In the first place, a British "assembled" car is still practically unknown, for no firm of any size or standing is buying engine, gearset, axles and other details in the open market; there are no firms with reputations able to supply all these parts, engines excepted, from standard designs, let alone offer a selection of models in each unit.

In part explanation of the continuance of pre-war methods, it is put forward that the extent of the home market has not been increased; true, there is an accumulation of orders to be worked off, but when the abnormal demands thus caused have been satisfied there will be no maintained calls from home buyers for "mass production" from a dozen sources. The British maker has, therefore, felt the need for prudence; he might quite easily embark now on a scale of production which, while appearing to be justified at the moment, would lead to bankruptcy in two or three years' time—when supply catches up with and exceeds demands and competition is felt once more.

As regards foreign markets, the scope and possibilities for development have not been forgotten, although it is doubtful whether they have been fully appreciated. One great difficulty of the British maker in this respect lies in the fundamental differences in the requirements of home and overseas users. Unlike the car manufacturer in the United States his British contemporary cannot produce one model that will satisfy both markets. The overseas prospect, in asking for a comparatively large engine of moderate efficiency and medium speed, one which will maintain its "tune" and original standards of performance for an indefinite period under hard conditions of use and even neglect, is demanding something which the British system of car taxation distinctly discourages and which

will be still further discouraged if the planned extension of that system comes into force on Jan. 1 next.

British users want highly efficient and high-speed engines of limited bore, low weight of chassis, restricted wheelbase, low seats with semi-reclining backs, limited height overall and with gear ratios planned for British use, not for the exceptional conditions met with overseas. In many ways, therefore, they oppose their demands to those of the overseas buyer. As a natural result, the output of "one-model-only" firms are almost restricted to the home market, while those who wish to cater to foreign trade as well must make more or less serious modifications and even then may fail to provide exactly what the majority of the overseas buyers are looking for.

A few firms—very few—apparently consider that their best interests will be served by catering first for overseas and offering the resulting product to home buyers. In one such instance, the chassis, designed to a reasonable price—despite the subsequent necessity for increases—has ample ground clearance for undeveloped countries. It has a fairly large ($3\frac{3}{4} \times 5$ in.) engine of medium speed and the standard body is a roomy five-seater with a full electric equipment and two spare wheels and tires. The makers in adopting this one-model policy have felt justified in planning for an output as large as any in England. Further, they have got down to production well in advance of the majority with proposed outputs of similar magnitude.

• But even the methods adopted in this case would not be accounted completely up-to-date in the United States with "mass production" in view. The reason for this should be evident when it is said that 200 chassis per week constitutes the limit of present aims. A week or two back the average output was in the region of 50, a record having been established with the completion in one particular week of 70 cars. And yet the biggest output in Great Britain is claimed—and not disputed.

To show the limited extent to which quantity production methods have advanced in England, the following general particulars may be of interest. They concern a typical plant that represents one of the half-dozen largest and best-organized concerns.

The layout of the works—mainly ground floor buildings—enables material to pass from rough stores to erecting shop progressively in the same general direction. After erection, chassis are taken to the body shops on small iron-tired temporary wheels, on which they move through the erecting bay—some 400 yd. away from the body shops and the painting and finishing departments.

The machine tool equipment is accounted up-to-date in Great Britain, but, while cylinder boring machine han-

ding four cylinders at once, modern gear shapers and one or two multiple drills are installed, there is very little either simultaneous machining of a number of identical parts, or milling, turning or planing two or more surfaces of one part at the same time. Special machine tools designed to suit any peculiarity of the details are entirely lacking. But the jig equipment is comprehensive, the same applying to gages and inspection methods.

There is nothing approaching a chain system of conveyors for parts or units. Each detail is man-handled between processes, hand trucks and trolleys being used for transportation from machine to machine or shop to shop.

The parts assembly shop handles the back and front axles at one end, engines farther along, gearsets adjacent, and so on, the units passing through from one side to the other, the far side from the machine shop being parallel with the erecting bay. Frames enter the latter at one end and are put on to axles and springs with temporary wheels. Thence, each chassis is moved along on these wheels to points where issue from parts assembly the other main components, the exit end of the bay finding chassis erection completed. The engine is there started up and the chassis driven under its own power to the body and finishing side.

Bodies of several types are made in the plant. The frame members are cut to jig, assembled individually and covered with panels shaped on the premises by rolling and hand beating. With each body on its own wheeled trolley, the priming and color coat is applied by spray. From the drying room it passes to the upholsterers, after which the first varnish coat is laid on by brush and unskilled labor and the final coat by skilled hands in dust-proof rooms after rubbing down in the open. Chassis are waiting outside the final varnishing rooms, the bodies are lifted into place off the trolleys and the cars then progress through electricians' and finishers' hands to inspection on completion. A road test is given to each completed car, after which it is submitted for final inspection before being taken to the shipping department.

A similar system with slight variations is used at other plants. These represent the highest existing standards in British production methods and they appear to serve satisfactorily for the outputs attained. Elsewhere there is more or less confusion, or, at any rate, excessive man-handling and transport from and to various parts of each shop and from one isolated department to another. There is too often lack of organization, with results that might be expected. Progress checks and "chasers" are certainly

more in evidence in nearly all plants than formerly and, without doubt, they are needed, for raw material deliveries are erratic to a degree; especially are many firms often help up by lack of frames—through no fault of their own or the frame makers, but by the inability of the steel plate firms to cope with demands.

But despite the restricted development in fundamental methods of production, in detail matters there is pronounced improvement. Jig designs are far more carefully thought out, and the use of jigs extends to parts that in 1914 were nearly always marked off for every operation and drilled or otherwise machined without extraneous assistance. Thus semi-skilled labor can be and is utilized where the officials of trades unions permit, with economy in labor costs and increased accuracy of product.

Small tools of special design are also more carefully considered, but more pronounced is the better discrimination in tolerances. Although it is difficult to induce a manufacturer to agree with the suggestion, it is freely put forward by independent observers that the standards of accuracy imposed during the war by the Aeronautical Inspection Department—the much-abused "A. I. D."—have had good and lasting effect.

On the one hand, we now have firms whose pre-war tolerances were so wide that they might well have been and generally were ignored; these are now, where it is desirable, working to limits as close as those applied to airplane engines, resulting in an almost entire elimination of the hand-fitting during assembly that was so pronounced in pre-war days. A higher standard of interchangeability without undue slackness of fit has followed, and most of even the very small firms have good reason to be proud of their accomplishments in this direction.

On the other hand, there are not the unreasonable and unnecessary standards of accuracy and external finish, where neither is of use or benefit, that were insisted upon in many plants in 1914 and earlier. Discrimination is more in evidence and it has been applied to assist toward economy, without detracting from excellence in performance of the completed car.

Thus tolerances have narrowed where accuracy is of advantage to all concerned, and have widened where narrow limits are unnecessary.

It is, therefore, in the detail development of existing or well-known systems where British production methods have improved, rather than in an endeavor to follow blindly the lead of American methods so admirably suited to larger outputs than can be reasonably contemplated in England.

The Braun Tube Oscillograph

MOST investigators are familiar in a general way with the principles of operation and the utility in electrical research of the cathode-ray, or Braun, tube. However, there has been very little development and constructional work done on these tubes in this country, chiefly for the reason that, except during the period of the war, cathode-ray tubes could be imported from Germany more cheaply than they could be made here. The price of a cold-cathode tube at present is about 60 marks in Germany, according to recent quotations. Hence, it is not surprising that rather meager information has been published in America concerning the general principles of design of such tubes.

A study of the design of cathode-ray tubes, which are suitable for ignition investigations, has been made by the Bureau of Standards. The device can now be designed and constructed with a considerable degree of certainty to

suit a variety of different operating requirements. As an implement of research, permitting visual observation of phenomena previously unseen and furnishing data for new ideas and new theories, the cathode-ray oscillograph performs a service that can be achieved by no other device.

The results of the Bureau's work on the design of these tubes will be available later as a scientific paper.

PREFERRED stocks of automotive and other industrial companies are described in a new book which has just been issued by the statistical department of Dominick & Dominick, members of the New York Stock Exchange. This book, which is entitled "Some Recent Issues of Industrial Preferred Stocks," brings together in convenient form the salient facts regarding forty of the principal industrial preferred stocks brought out within the past year.

Correlation of Shop and Classroom Work in Training Machinists

The three-year training course for apprentice machinists conducted by a large tire concern includes a number of significant methods. The problem of successfully correlating actual practice with theory is handled in a particularly effective manner, as described in the following article:

MANUFACTURERS are beginning more frequently to assume the responsibility of properly training the men who are to work for them. The necessity for industrial training in many fields becomes more apparent each year. Sales schools, service schools, and schools for skilled mechanics are increasing in number, while the tendency to put a man on a job to learn by experience alone is decreasing to a marked degree.

Methods of training, however, are as yet in a state of primary development so far as most plants are concerned and many valuable ideas can be gained from an established course already in successful operation. The Goodyear Tire and Rubber Co. has developed training courses for its employees along many lines, the most interesting of which from the standpoint of the automobile manufacturer is the three-year apprentice training course for machinists. This course admits boys between the ages of sixteen and eighteen years, and comprises some novel and interesting developments in the training of skilled machinists. Though a tire manufacturing concern, good general machinists are always needed at this plant, and consequently an apprentice school is supported.

On starting the course, the boy enters a three-months' probation period. During this time, the instructors can estimate the capabilities of the student and the student can form an intelligent opinion as to whether or not he wishes to complete the course. As a result, very few of those who pass through the probation period fail to complete the entire course.

The boys work eight hours a day and are paid for the entire time, although two hours are spent in the class room and six hours in actual work on machines. They receive 35 cents an hour at the start, while an increase of 2½ cents an hour is added every six months. They receive their pay weekly, as do the other workmen in the plant, but 2½ cents an hour is held back by the company and is paid to them at the completion of the course. When a boy is 18 years of age and has been with the company for six months, however, he receives the regular shop minimum wage of \$6 a day. The difference between his regular rate and \$6 is then held back.

Sixty-five boys are now being trained in this way. The shop work is done in two shifts. The first shift works from 6.30 a. m. to 12.30 p. m., while the second shift works from 12.30 p. m. to 6.30 p. m. In this way the machines on which the boys work are utilized to the fullest advantage. While one shift is working on the machines, the other shift is having its class-room work.

The class-room work is divided as follows as regards hours per week spent on the different subjects:

| First Year | | Second Year | |
|------------------------|---------|------------------------|---------|
| Arithmetic | 2 hours | Mathematics | 1 hour |
| Drawing | 2 hours | Drawing | 2 hours |
| Physical training..... | 4 hours | Physical training..... | 4 hours |
| Meeting | 1 hour | Meeting | 1 hour |
| Co-ordination | 1 hour | Co-ordination | 1 hour |

Third Year

| | |
|-------------------------------------|---------|
| Physics and laboratory science..... | 3 hours |
| Mechanics | 1 hour |
| Physical training | 4 hours |
| Meeting | 1 hour |
| Co-ordination | 1 hour |

The hours designated "Co-ordination" and "Meeting" perhaps require additional explanation. The boys have an organization of their own, with officers, officials, etc., which meets for one hour each week. In this meeting they discuss anything they wish, either in connection with the work, the course of study, or their athletic and social activities. The course in co-ordination is a definite effort to bring before the pupils in a concrete and practical way the intimate relationship between the various class-room studies and the shop tasks which they have performed during the week.

The entire course is carefully designed to correlate closely the shop and the class-room work. Such correlation has always been difficult to attain, and the Goodyear course, consequently, is particularly interesting from that standpoint.

There are five divisions to the work, namely, shop work, mathematics, drawing, science, and English. To properly visualize the correlation of these divisions, a chart has been prepared and the work on each machine planned in detail. Fig. 1 illustrates the general layout of the chart. In a vertical column on the left-hand margin appear the five divisions previously mentioned. The horizontal line of headings comprise the various machines as follows: drill press work, engine lathe work, planer work, shaper work, screw machine work, milling machine work, bench assembly work, grinding work.

Listed vertically under "Drill Press Work," for example, are the detailed operations and principles taught in the different divisions in regard to the drill press. In-

| | Drill Press Work | Engine Lathe Work | Planer Work | Shaper Work | Screw Machine Work | Milling Machine Work | Bench Assembly Work | Grinding Work |
|-------------|------------------|-------------------|-------------|-------------|--------------------|----------------------|---------------------|---------------|
| Shop | | | | | | | | |
| Mathematics | | | | | | | | |
| Drawing | | | | | | | | |
| Science | | | | | | | | |
| English | | | | | | | | |

Fig. 1—General outline of correlated study board, which visualizes the way in which the various phases of shop and class-room work are related to one another

stead of teaching the class-room studies as separate courses, mathematics is taught in relation to the drill press, drawing in relation to the drill press, science in relation to the drill press, etc. Then when the work on the drill press has been completed and the student passes on to engine lathe work, for instance, more mathematics is taught, this time in relation to the engine lathe. In brief, the course is taught in units of machines instead of subjects; the various subjects are correlated in their relation to the individual machines, instead of the machines being fitted into their places in the subjects as is usually done even in the vocational or trade school.

This plan has distinct advantages. It shows the student clearly the practical value of the book studies which he takes, and enables him to apply his knowledge immediately and effectively. Moreover, it insures the elimination of all unnecessary or impractical material from the course.

The present mechanical equipment consists of 22 machines, while 12 new machines are about to be installed. Only 22 machines, however, are being used to train the present 65 members of the course. The list of machines is as follows:

- 9 lathes
- 2 millers
- 2 shapers
- 1 planer
- 2 screw machines
- 3 drill presses
- 3 bolt cutters

A practical example will illustrate best the thoroughness of the instruction and the methods of correlation. Following is the detailed work which is taught in connection with the engine lathe. Listed on the large chart, of which Fig. 1 is a small reproduction, this appears in the vertical column under the heading "Engine Lathe Work." Thus, by means of the chart, the correlation of the various parts of the engine lathe instruction can be seen at a glance.

ENGINE LATHE WORK

| Machine Operation | Knowledge of Machine and Attachments |
|---------------------------|---|
| Care of Centers | Name, care and use of the principal parts of machine: |
| Turning on Centers | Carriage |
| Turning on Mandrel | Apron |
| | Cross-feed |
| | Compound rest |
| | Bed |
| | Ways |
| | Head stock |
| | Tail stock |
| | Back gears |
| | Change gears |
| | Spindle |
| | Lead screw |
| | Spline shaft |
| Chuck and Face-plate Work | Various kinds of checks: |
| Facing | Independent, Universal, Combination, Collets or Draw-in, and Special Face-plates, |
| Drilling | Steady rest, Follower rest |
| Boring | Use of Change Gears, Lead |
| Reaming | Screw, Carriage and Cross-Feed Index |
| Thread Cutting | Taper attachments |
| Taper Turning | Compound rest |
| Knurling | Tail stock adjustments |
| Filing | Backing-off or relieving attachment |
| Polishing | |

LATHE WORK

MATHEMATICS

Layout of machinist's rule
Finding center of circle { By eye
By center square
By dividers
Linear measurements
Reading decimals
Decimal equivalents
Changing decimals to common fractions
Changing common fractions to decimal fractions
Reading micrometer
Reading depth gauge
Reading micrometer adjustment of cross slide
Calculation of standard tapers
Figure approximate set over for taper
Standard threads for given diameters
Pitches of threads
Gearing
Change gears for threading
Layout by construction the form of a templet
Read degree scales (protractor)
Lay off angle
Solution of the cylinder
The 45 degree triangle
Solution of right triangle by trigonometry
Solution of the circle
Allowance for fits

LATHE WORK

DRAWING

Principal dimensions of objects
Placing of views
Third angle projections
Dimension of length and diameter from drawing
Dimension from assembly drawing
Conventional methods of representing taper
Thread convention
Methods of indicating threaded holes
Supply missing dimension on drawings
Detect wrong dimensions

LATHE WORK

SCIENCE

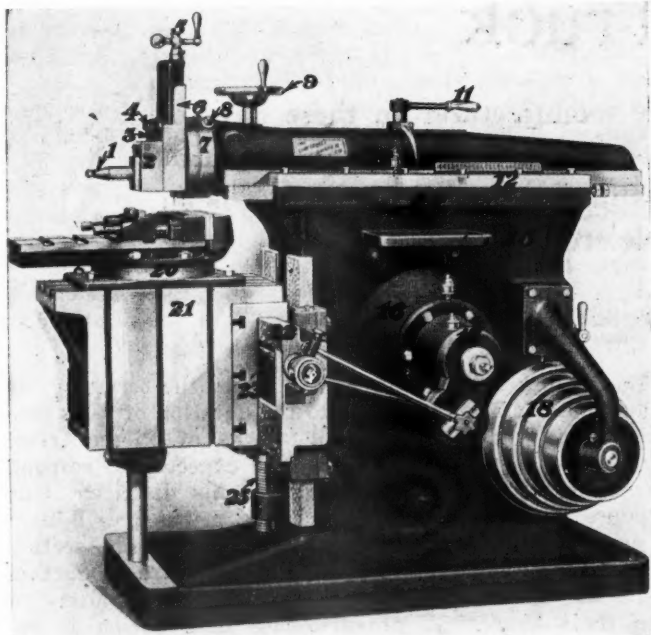
Lubrication of bearings and centers
Expansion of work due to heating
Use of screw to move carriage
Use of friction in clutches, belts, etc.
Spring of tools
Lever to magnify motion
Lever to magnify force
Lever as applied to clamping

LATHE

Inflection:
Nouns: number
gender
case
person
Verbs: tense
principal parts
conjugation
Study of Auxiliary verbs
The forming of the sentence:
Clauses: Kinds
Uses
Spelling:
Parts of lathe
Parts of planer
Parts of screw machine

Note:—Written assignments are assigned on Lathe work

The length of time necessary to thoroughly instruct the average student in the use of each machine has been determined. That time is only approximate, however, as ability of individuals differs greatly. This personal factor is taken into consideration in giving the course, so that the boy who learns rapidly will not be held back by hard and fast rules, nor will the boy who is a little dull be hurried over some portion of the work without thoroughly understanding it.



- | | |
|------------------------|--------------------------|
| 1. Tool post. | 14. Ram guide. |
| 2. Clapper block. | 15. Frame or body. |
| 3. Clapper box. | 16. Feed box. |
| 4. Clamping bolt. | 17. Feed regulator. |
| 5. Down-feed screw. | 18. Cone driving-pulley. |
| 6. Tool slide. | 19. Vise. |
| 7. Tool head. | 20. Swiveling base. |
| 8. Binder for head. | 21. Table. |
| 9. Ram adjuster. | 22. Saddle. |
| 10. Ram. | 23. Cross-feed screw. |
| 11. Positioning lever. | 24. Cross-feed dog. |
| 12. Ram slide. | 25. Elevating screw. |
| 13. Face of Column. | |

Fig. 2—A typical spelling lesson used in the apprentice training course

The schedule of approximate times in months is as follows:

| | |
|--------------------------------|----------|
| General apprentice shop..... | 1 month |
| Bolt cutter (2 types)..... | 1 month |
| Drill press (4 types)..... | 2 months |
| Lathe (6 types)..... | 5 months |
| Shaper (3 types)..... | 3 months |
| Planer (2 types)..... | 3 months |
| Milling machine (3 types)..... | 5 months |
| Screw machine (3 types)..... | 3 months |
| Boring mill..... | 3 months |
| Specializing..... | 3 months |
| Tool room..... | 2 months |

Three months are given to specialization work on any machine which the student may select. This work comes at the end of the course, and enables the boy to be graduated not only with a good knowledge of general machine work, but also with considerable skill on a particular machine.

Several very novel methods have been introduced into the Goodyear course, one of which is the practical method of teaching spelling. Fig. 2 illustrates a typical spelling lesson in this apprentice machinists' course. The picture is used in connection with the spelling lesson as well as the list of words. Thus the instruction serves two purposes: it teaches the student to locate and recognize as well as to spell the names of the different parts of the various machines. Spelling is a part of the course in English.

A second novel feature is the method of marking students and determining whether or not they have passed in every phase of their machine work. Four grades are used in marking: E—Excellent; G—Good; F—Fair and

listed the various operations which the student learns on a milling machine, for instance. These operations are listed in a vertical column, and beside each one are four additional columns headed U, F, G, and E, respectively. The grades of the individual student are then recorded by the instructor in these squares.

For every machine, however, there has previously been prepared a master card, from which certain squares have been cut. The master card was prepared after careful study and investigation and indicates the degree of proficiency in each operation which the student must have to do satisfactorily the class of work demanded in the Goodyear plant. Thus the master card for Milling Machine Work illustrated in Fig. 3 shows that the student must make a grade of E in plain milling or he does not pass, while a grade of F is considered passing in reaming, plain indexing, compound indexing, etc.

When this master card is superimposed upon the student's marked card, the operations in which the student has not come up to the required standard can be determined at a glance; a cross must show up for every operation. Where the cross does not show up, an operation in which the student is not proficient is indicated and he is required to do that operation over again until he learns it thoroughly.

The boys do a great deal of general repair work during their course, and some regular production work is about to be introduced. A number of features are contained in this training which might be adapted to almost any similar course.

| MILLING MACHINE WORK | | | | | Knowledge of Machine | | | | |
|----------------------|---|---|---|---|----------------------------|---|---|---|---|
| Machine Operations | U | F | G | E | U | F | G | E | |
| Plain Milling | | | | | Plain Machines | | | | X |
| Slotting | | X | | | Universal " | | | X | |
| Sawing | | X | | | Special " | | | | |
| End Milling | | | | X | Bed | | | X | |
| Vertical Milling | | | | | Table | | | X | |
| Taper Milling | | | | | Cone | | | X | |
| Drilling | | | X | | Spindle | | | X | |
| Boring | | | | X | Gears | | | | |
| Centre Boring | | | | | Arbors | | | | |
| Reaming | | | | | Chucks | | | X | |
| Plain Indexing | | | X | | Feed adjustments | | | | |
| Compound " | | X | | | Vices | | X | | |
| Differential " | | | | | Plain Centers | | X | | |
| Straight Fluting | | | X | | Index " | | X | | |
| Spiral " | | | | | Indexing Head | | | X | |
| Staggered " | | | | | Vertical " | | | | |
| Graduating | | | | | Gearing for spiral milling | | | | |
| Gear Cutting | | | | | | | | | |
| Bevel Cutting | | | | | | | | | |
| Shaping | | | | | | | | | |
| Cam Milling | | | | | | | | | |

Fig. 3—Master card used in determining whether or not a student has fulfilled requirements of the course. The crosses are on the student's marked card over which the master card has been superimposed. The student is shown to have failed in taper milling, reaming, and several other operations

LIEUTENANT COMMANDER LIND, formerly a teacher at the United States Naval Academy, has written a practical treatise on Internal-Combustion Engines. The treatise is intended as a textbook for engineering classes and also as a practical reference book covering the essential features of the various types of

Methods of Merchandising the Motor Truck

Truck selling offers few obstacles to the manufacturer in these days of heightened demand, but the creation of a sales organization that can meet resistance and overcome handicaps in a more difficult market is an insurance against disaster. This article relates one successful plan.

By Clyde Jennings

AS the truck comes more and more into its rightful place in the trinity of transportation—Railroads, Waterways and Motor Transport—the proper selling of the truck becomes of increasing importance.

Recent investigations in the selling field have shown beyond a doubt that the truck is not to be merchandised successfully by the methods in which the passenger car has been sold by the more or less indiscriminate selection of local dealers, telling them to go to it. The investigation referred to has shown that the passenger car dealers who took on truck lines during the war are dropping them. Or, if they retain the lines, they are merely selling a truck when someone wants to buy one. It seems to be demonstrated clearly that truck and passenger car selling are things apart. The success with cars does not insure success with trucks to an appreciable degree.

An apparent difficulty in the appreciation of this situation appears to come with the fact that the salesmen of passenger cars and trucks have not had the experience of selling against a determined resistance. There have been too many buyers and, in regard to trucks, this state of trade appears likely to be continued for some time.

But this does not lessen the obligation of the truck manufacturer to build a selling organization that can meet resistance and keep business going if the sellers' market should cease. The same, of course, is true as regards the car manufacturer. An efficient selling organization should be regarded as an insurance against disaster.

In this connection, the following remarks by George M. Graham, general sales manager of the Pierce-Arrow Motor Car Company, on the broad subject of building an efficient sales force, should be interesting.

The Pierce-Arrow problem is somewhat different from that of a good many truck makers because it is built solely on the distributor plan. But, because the company does business through local merchants, its sales department has not washed its hands of local problems. In fact, it probably will develop that the Pierce-Arrow sales department is more closely in touch with local problems than are the factory sales departments of companies that work through the branch systems.

In the first place, the distributor has won his position in the sales plan because of his efficiency in Pierce-Arrow methods. He could not otherwise gain this place—certainly not merely because he is financially able to buy sufficient trucks to make a showing for the territory allotted to him. The idea behind a Pierce-Arrow truck is that it must give to the consumer the ultimate service for which it is designed. The distributor is the link between the factory and the consumer to bring this about. He must be able to combine finance, sales and service.

The factory sales department outlines the territory for a distributor. Then it goes into the question of sales possibilities in that territory for trucks of Pierce-Arrow quality and capacity. The dealer is expected to respond in proportion to the possibilities of his district. This response for the present is factored on the possibilities of production at the factory. The fact that one section of the country might be able to take the entire production would not lessen the obligation of other distributors to take their share. A proportionate distribution is regarded as the sound basis of a national sales plan. There must be the sound basis of the future for an increasing production and an ever-widening radius of employment of the trucks now in use.

The factory goes much farther with the distributor. While the selection of local points of sale within his territory is his problem, the factory sales department does not "pass the buck" on this problem. Instead, there is continued co-operation in the apportionment of sales capacity in special locations within the distributor's territory. He is assisted with these problems and building specifications for purely local agencies are supplied for his use. These show the apportionment of space to salesroom, parts stock, service, etc., for a building in a community of an estimated sales capacity. They are worked out as the result of experience and, naturally, avert a great many mistakes on the part of the local dealer. Every opportunity to avoid mistakes, that will certainly develop discontent, is given.

The strongest single feature of this plan of co-operation between dealer and factory probably is the factory sales school. This applies to both the truck and passenger car problems. The option of sales is given to the student at the proper period of study.

A class of twenty-five is usually arranged, as this appears the maximum for which the proper personal touch can be established. Students enter the employ of the company the day the class begins. They are regularly hired for a three months' period at a wage that provides for a reasonable living during that period. The ideal for a student in this class is a man who has demonstrated an ability to sell merchandise of value. A fruitful field is that of pianos, talking machines, washing machines and similar lines. There usually are enough applicants to recruit a class without special effort, but a veiled advertisement always brings the desired results if more men are wanted. The selling record and personality are the basis of employment for this period. Mechanical ability is not highly regarded, as it is considered a more reasonable proposition to educate a man in mechanics than in selling. The natural sales ability is the basis on which the school works. Salesmanship is developed but not

created. In an aside, it might be remarked that the best salesman developed in two years was a whiskey salesman, who saw prohibition coming and dodged early.

An early feature of the course is the Pierce-Arrow story. The men are sold strongly on the plant and its products. This is the background for future loyalty. There are lectures on business methods and examinations. It is real work and close attention to details that are required. At no time is a hint of the "joy ride" permitted to enter. For one month there is only one course, which applies equally to cars and trucks. Then the option of a special development is offered and the men separate into two groups. There is no compulsion, but in some cases the younger men are advised to go to the cars. This advice is based on the proven theory that mature men make better headway in talking trucks to a business man than the youthful-appearing salesman. It is regarded as true that business men generally resent an analysis of their business problems by a boyish-looking salesman, but this youngster, if he has the proper address, can very well sell passenger cars.

As a rule, the men graduated from this school are engaged before their course is completed. This is brought about by giving them an opportunity to meet the dealers who visit the plant. There is a constant dealer demand for salesmen and the contact is arranged for as a feature of the dealer's visit. Very rarely is it necessary to let a man go after he has taken this course without a trial in the field, and it is the exception for a man to remain at the plant for a month after his course has ended.

Sales Methods

The school has been in existence four years, and 60 per cent of all men graduated are connected with Pierce-Arrow distribution to-day.

Some of the members of the faculty are specially engaged, but the experts are men connected with the organization. This is true in background, mechanics, salesmanship and service, and is regarded as desirable because the regular staff of the company has the interest of the company at heart to a greater degree than specially engaged men, and their earnestness carries to the students.

There are some recent tendencies in truck selling not entirely accepted in the Pierce-Arrow plan. One of these is to sell transportation rather than the truck. The training here is strongly that Pierce-Arrow products are a large factor in the selling. Transportation is a part, of course. The men are given no little training to the end that they can help the customer solve his problems, but he is not permitted to overlook the fact that this is a Pierce-Arrow solution and that the quality of the product is the big factor. Also, that the advertising and reputation of his vehicle are big factors.

In selling this school to the prospective student, the records of the graduates are quoted. It is pointed out that it apparently is not difficult for the graduates to earn \$3,000 a year, while in a number of instances men working on a drawing account and commission have earned in excess of \$10,000 a year. Also that other graduates are holding executive positions in distributor organizations and some are dealers and a few already are in distributor firms.

While the school is regarded as a valuable feature of the selling organization, there are other features which must not be overlooked. The Pierce-Arrow products are marketed practically on a cash basis. There is no such thing as a consignment deal. Only parts are sold on open billing and the settlement dates on these bills must be met promptly.

In speaking of this feature, Mr. Graham said that he had the opportunity recently of looking over a sales plan of

a truck manufacturer who had a list of 450 dealers with which it maintained direct contact, and to which it shipped trucks on consignment. This company also turned out nine models of trucks. Here were two ordinarily fatal handicaps. One in the great credit necessary in selling and the responsibility of maintaining service that must, by the very nature of the job, be very thinly spread. A second handicap is the impossibility of maintaining a proper production cost with the multiplicity of models.

The Small Town Dealer

As to the method now used by a number of large town dealers of using the small town motor car dealer as a tipster and so paying him a small commission on sales in his community, Mr. Graham did not venture an opinion. He said that this was a problem for the dealer to solve in his own way. Graham does, however, strongly favor the junior and senior staff systems, wherein the work is divided to keep the more competent salesmen on work that is worthy of their time. Sources of information must be maintained and, if the small town dealer could fill this place, it would be a very good point.

There was one feature of truck selling that is at present neglected. This is the research as to uses for trucks. Under present conditions, the salesmen are working on a drawing account and commission basis, the drawing account being a mere living. As a result, it is only natural that the salesmen work along the line of least resistance and sell to the best prospects on their lists. It meant good business all around, but it was not a line of work that made for the future, no more does it equip the men for original work. It is a fair weather policy, good as long as the present channels of prospect hunting keep the prospect lists of sufficient length. It was Mr. Graham's thought that the successful salesmen should devote some time, say three days a month, to the development of new business. For these three days they should discard all prospect lists and look for sources of sales that are not known, for new uses for trucks and for territories not yet touched by motor transportation routes. This should be original work by men trained in selling and in truck observation. It would be of profit to the dealer and to the industry, and beneficial to the men themselves. A plan for financing this work must be arranged, as it would hardly be fair to the salesmen to make them carry the burden of three days' loss of commission. They might be paid for these three days at the rate they earned the balance of the month. This arrangement would undoubtedly be of great value to the dealer. The benefit to the men would come in the training in original work.

Future of the Truck

The future of the truck is not questioned at the Pierce-Arrow plant. Some changes are foreseen. One is the necessary standardization of the vehicle to make for economic use of the truck. The small truck, below the vehicle of 2-ton capacity, is not looked upon as a truck industry product.

The truck above 5-ton capacity is not needed in considerable quantities. For a long period it must be an urban proposition, because the roads outside the cities cannot now support it.

This leaves the field for the real manufacture of trucks between the 2 and 5-ton class. In this range three models will easily meet the demands. To follow those lines will simplify greatly the selling and manufacturing problems.

When reduced to these limits, Mr. Graham welcomes the entry of the pneumatic-tired truck as the greatest development of the immediate future. It is an engineering problem that is being well worked out and one that can be quickly capitalized by the sales forces.

Curtailed Credits Help to Balance Inventories

Purchasing agents at N. A. C. C. meeting predict lower material prices. The evils of too much stock chasing were discussed, the general indication being that much less will be done in the future. Price increases, subsequent to a fixed-price contract, will be scanned carefully

By J. Edward Schipper

CLEVELAND, June 18.

A STRONG effort on the part of the automobile and truck industries to do away with the present condition of unbalanced inventories is now under way. A great many of the factors which will make this movement possible and successful were brought to light at a meeting of the purchasing agents of concerns affiliated with the National Automobile Chamber of Commerce here to-day. From the various discussions which arose at the meeting, it is apparent that the era of highly competitive buying of essential parts for automobiles and trucks is passing, and this condition is leading to a far better state of affairs from the buyer's standpoint. In fact, it was openly expressed by some of the most prominent purchasing agents at the meeting that at present we are really beginning to have a buyer's market, although the fact is concealed somewhat by the difficult transportation situation.

The limitations recently imposed on credit and the discouragement of long time purchases of automobiles and trucks have had a tendency to soften demand, which is reflected back through to the raw materials, leading to the belief that price decreases will soon become general through the basic materials. This situation has been awaited for some time by well posted purchasing agents, and has led to more conservative buying, which, in turn, has had a helpful influence on inventories. It is frankly admitted by manufacturers generally that the unbalanced inventories existing at the present time are the greatest problems which the industry has to face, and it is conceded that even with a softening of the market, due to restricted credits, that immense benefits will accrue to the industry generally, if it is able, through this condition, to straighten out its inventories.

Some of the specific materials which purchasing agents at the meeting stated they have been able to buy recently at reduced prices include pig iron, copper, forgings, oak, ash, leather, and some of the non-ferrous metals. It was also stated by some that while the present market for new machine tools is very firm, it is believed that this will

soften under the influence of the notable reductions in second hand machinery which have recently been made. This view, however, is not unanimously held, as opinion at the meeting was equally strong that machine tool prices would continue at their present level for some time to come. It is the belief of many of the purchasing agents that the used machinery now on the market is not of sufficiently high quality to really affect the new machine tool market.

The meeting, which was presided over by Alfred Reeves, general manager of the National Automobile Chamber of Commerce, was opened by F. L. Kulow, purchasing agent of the Willard Storage Battery Co., and also

president of the National Association of Purchasing Agents, many members of which were invited to attend the meeting. No set papers were read at the meeting, but a number of subjects were laid open for discussion. These included, "Methods of following up material with question of dispensing with the use of stock chasers"; "Possibility for deliveries of materials by parts manufacturers on confirmed and accepted orders at stipulated prices"; "Means of obtaining information as to the capacities of various unit manufacturers, and amount of orders

WITH the present credit situation approximately 50 per cent of the credits advanced to concerns handling long time automobile paper have been withdrawn. This is not an unhealthy condition, but will probably be the means of establishing the industry on a firm basis as regards inventories.

It was the consensus of opinion that stock chasers are always an evil, but a very necessary one during unusual transportation conditions, or unusually difficult delivery situations as at present. During the recent difficult times in securing deliveries of parts, all the executives in some organizations from the president down were stock chasers.—From the meeting of Purchasing Agents of the N. A. C. C.

they actually book"; "Standardization of purchase forms" and "Possibility of drop in prices and best protection against decline."

It was the consensus of opinion that stock chasers, that is, men who are continually on the road or stationed at different parts of the country to look after stock deliveries, are always an evil, but a very necessary one during unusual transportation conditions, or unusually difficult delivery situations as at present. During the recent difficult times in securing deliveries of parts, in some organizations all of the executives from the president down were stock chasers.

It is apparent, however, from the discussion that stock chasing has been overdone and that if the industry would mutually agree to limit stock chasers, it would be of benefit to all. One example was mentioned where in a certain small town in the western part of Michigan, four-

teen stock chasers camped at the local hotel all trying to secure a similar part from one concern, with the result that at first these stock chasers disrupted the organization by persuading the management to break into its production schedule in order to accommodate some of its customers. The final result was that all of the stock chasers were barred admission, and although they were eating up expense money and saddling this cost on the industry, they were accomplishing nothing.

On the other hand, it was shown that certain stock chasing had a very legitimate excuse for existing. Many of the manufacturers at the meeting expressed themselves as believing that the remedy for the stock chasing situation is to so select the sources of supply and to establish such close relations with them that confidence in the ability to secure a fair share of production is established. The older companies which have been dealing for a long time with well established parts manufacturers are, of course, having the least amount of difficulty in this respect and finding the least need for stock chasers.

The Traffic Situation.

In connection with a discussion as to when a stock chaser was a stock chaser and when he was a traffic man, Alfred Reeves pointed out that the traffic situation looked bad for some time. The railroads need supplies and are getting them only very slowly, so that it looks as if it is going to be necessary to use the trucks for all short haul work. Indianapolis concerns have combined less than car-load shipments of similar kinds of material for different Indianapolis factories into complete car shipments, with the result that this has expedited deliveries and cut costs to the plants. Another interesting fact was brought out in connection with the discussion on stock chasing. Very frequently it happens that while one stock chaser is successful in having a parts concern tear down a machine and start work on a part for his company, in some other plant another stock chaser might be doing the same thing, with the result that neither of the two concerns is ahead.

It was generally believed that parts and materials are moving more uniformly and the market is easier now than in the period just passed, and it is probable that while traffic men will be necessary for some time to come, the number of stock chasers will begin to be materially reduced almost immediately.

Price increases by parts manufacturers, in spite of contracts on a fixed price, will be scanned very closely, according to several of the purchasing agents who discussed this topic. While the consensus of opinion at the meeting showed a disposition to meet a rise in material prices with fairness, the objections made were against the alleged practice of some of the parts manufacturers of taking orders at increased prices and then neglecting those previously taken at lower prices. It was pointed out that a great many of the price revisions by the parts manufacturers are due to the fact that raw material prices are revised quarterly. This quarterly fluctuation has, of course, led to a great many legitimate demands for increased prices, in spite of previous contracts, and there has been a marked disposition on the part of manufacturers to recognize this situation.

The Unbalanced Inventory.

On the other hand, the feeling was expressed that a great many parts concerns had taken advantage of this situation and purchased contracts that had lost a great deal of their value through repeated abrogation. Necessity for preserving the inviolability of a contract in order to establish stable business relations was pointed out very forcibly, since some concerns have even gone so far as to wish to back up on prices on goods already shipped.

Analysis of the opinion of various purchasing agents

shows that the unbalanced inventory has largely been responsible for this situation, because a concern may have several million dollars tied up in parts, but still be unable to deliver cars or trucks on account of a few thousand dollars' worth of materials. This few thousand dollars might represent such a small percentage of the total load carried that the manufacturing concern will be willing to pay almost any price, even 100 per cent above market, in order to get the materials so as to make deliveries.

With the present credit situation and with conditions, as Alfred Reeves pointed out at the meeting, such that approximately 50 per cent of the credits advanced to concerns handling long-time automobile paper have been withdrawn, a noticeable softening of the market is sure to exist. This is far from being an unhealthy condition; in fact, it will probably be the means of establishing the industry on the firmest possible basis as regards its inventories. Many of the purchasing agents at the meeting agreed that it was not the cost of material or labor which is fixing prices, but it is the demand situation. With the anticipated demand shrinkage in plain view, prices on the basic materials have already felt the effect, and several instances were reported by the purchasing agents of concerns asking for orders where previously they could not fill the demand. The items mentioned at the head of this report were specifically mentioned and the general impression prevailed that other items could be included in the list.

The situation, as Alfred Reeves pointed out, has come up in other industries, but in a far less desirable way. In other industries price inflations have gone on to such a point that suddenly the buying market collapsed, leaving great reserves of stock to be disposed of at any price which could be secured. Examples of this, as given by Mr. Reeves, are in the clothing and silk industries. At the present time in New York City tremendous clothing sales are being held in such places as Madison Square Garden, where suits are being sold at prices which are, in some instances, less than 50 per cent what they were a few months ago. In the automobile industry the contraction is taking a logical and firm course, but it will be a thoroughly indicated development during the next six months.

Aerial Research and Education in England

RECOMMENDATIONS of a committee under the chairmanship of Sir Richard Glazebrook, appointed by the late Secretary of State for Air, Lord Weir, to replace the Advisory Committee for Aeronautics by an Aeronautical Research Committee, and also to establish a Department of Aeronautics at the Imperial College of Science, have been adopted. The principal terms of reference of the Aeronautical Research Committee are to advise on scientific and technical problems relating to the construction and navigation of aircraft; to undertake, or supervise, experimental or research work; to take over complete responsibility for the Air Inventions Committee and for the Accidents Committee; to promote education in aeronautics by co-operation with the governors of the Imperial College; and to assist the aeronautical industry of the country by scientific advice and research. Sub-committees will be appointed to deal with accidents, air inventions, aerodynamics, engines, meteorology and navigation and other matters, as required. The organization and staffing of the Department of Aeronautics at the Imperial College are proceeding under the direction of Sir Richard Glazebrook, as Zaharoff Professor of Aviation, and the recommendation of a grant from public funds toward the cost of the department has been approved.

European Events of Interest to American Automotive Industry

Events of considerable interest to the American automotive manufacturer are occurring throughout England, France, and other European countries. The following digest of recent occurrences is made up from reports of AUTOMOTIVE INDUSTRIES' special correspondents.

BRITISH Production Improves.—Reports generally agree that British car production is much better than seemed likely up to a few weeks ago. Among the probable causes of the increased production are the larger output of coal, enabling the steel workers to increase volume, and the gradual reduction of arrears of orders for castings held up by the 15 weeks' strike of the iron moulders.

The shortage of bodies continues, chiefly due to a lack of skilled and semi-skilled labor for upholstering; a feature which might long since have been changed but for sticking to the conventional form of rigid squabbing, which can only be done by hand-labor.

Trend in British Design.—A large number of American trucks are now on British roads. American manufacturers interested in this market should regard certain trends now taking place.

As the bulk of these trucks have well-dished and durable wood wheels, there is less reason for so many of them to have such overhanging axle ends and hubs. British truck makers are now almost in line in this matter, which is desirable as a preventive of accidents and injury to vehicles by collision with overhanging hubs. Another point is the use of unequal diameter wood wheels. The trend here is to use equal size wheels, which facilitates tire changing, and to use as large a diameter wheel as possible, which eases the steering. It may be added that the trend toward air-tiring charabancs (a sort of roomy "observation" car holding 24 to 36 persons) is becoming marked, and apparently is seen to be more economical than the band-tire.

There appears to be a big demand shaping toward the use of artificial materials for body panels and mudguards and for upholstery of car bodies, especially for mass-production cars. A material called "Panelite," a sort of compo-fibre in sheets about one-eighth inch thick, is being used instead of metal for body panels, wheelguards, and dash panels. It is merely tacked on to the wood framing and the surplus pared off with a pruning knife. Improvements probably will result in the substituting of some form of angle or other sections of metal strip instead of wood for the body frames, the section being shaped to templet, and cut and joined as a whole with blow-pipe welding. The "panelite" sheeting will then be bolted on, the holes being already templeted. Detachable back and side squabs, of course, will be used, but there is no novelty in that feature. The material finding favor for upholstery is American made.

Service in England.—Service is only beginning to be discussed in England and probably is unknown elsewhere in Europe. It is largely the outcome of the big hold of the American trade on the British market, since

almost all the American makers provide some form of post-sale service for the buyer's benefit. Before the war, the late Argyll company of Scotland, the Daimler company of Coventry and probably one or two of the makers of the most expensive vehicles had or were about to institute a system of touring inspectors who periodically visited owners and reported on the conditions of their vehicles. This sort of service is beginning to loom up, and should do something to improve alike the quality of average garage work and to assist private owners in keeping their repairs and fuel costs reasonably low. Among the latest companies to start this visitation service is Vauxhall. Their plan provides for an inspector to visit different parts of the country from time to time and to hold himself at the disposal of Vauxhall owners in the district for the purpose of examining and reporting free of cost upon the mechanical condition of their cars.

Foreign Trade.—America having maintained her automobile import duties at 45 per cent, representatives of the French, English and Italian automobile industries have decided to abandon their plan for a reduction to 33 1-3 per cent. This plan had been adopted in order to obtain uniformity throughout the automobile producing nations of the world. England already has adopted a 33 1-3 per cent duty, France has a 45 per cent duty, Belgium has not made any change since 1913 and Italy also has pre-war import rates. Recently, however, France has forbidden automobile imports when the weight is less than 2500 kilos, and a similar measure has been taken by Italy. The assumption, therefore, is that when the embargoes are removed, France, Italy and Belgium will adhere to a 45 per cent import duty. Whether England will increase her duty from 33 1-3 per cent to 45 per cent is not known.

Two attempts have been made through the Legislature to undermine the free trade policy of Great Britain. Both have been under the appealing title of "Anti-Dumping" Bills. Both have been defeated. The result is virtually a renewed declaration in favor of free trade and the intention is to resort to it as soon as possible.

These facts have at least an indirect bearing on the future of the existing tariff on imported cars and parts. At present the Government have given only a nebulous indication of their intentions regarding its retention or removal, but must do so before long, as the tariff period originally fixed will automatically expire in a little while. The tariff was imposed first as a war time measure, partly to restrain the import of unnecessary "luxuries," and for revenue purposes. It was continued as a post-war interim necessary measure to enable the home manufacturers to resume their normal trade. If it is to be retained, it must be justified on some other grounds, and

as the country has not formally approved by the test of a general election to the legislature a change of fiscal policy, it is doubtful if the Government have the necessary authority to continue the tariff.

The *Monthly Journal* of the British Chamber of Commerce offers a rosy view of the prospects for motor vehicles in Egypt. It points out that the cars most suited must be rigid, sandproof, have at least 10½ in. ground clearance, need not be high-powered, as the country is flat, and should be moderately light for their power. Heavy trucks are not wanted, but there is a good scope for air-tired trucks of light tare. There should be a good field for tractors and power implements as soon as the natives have been educated to appreciate the economic use of this sort of plant. Apparently there is no dearth of gasoline; therefore there is no need to fit kerosene attachments.

American Trucks in French Army.—After possessing practically every known make of automobile and truck, the French army is taking steps to reduce the number of types in service for military purposes. The list is still very long, for it comprises 70 distinct types of cars and trucks manufactured by twenty-six makers. The great majority are of French construction, but a few foreign makes are allowed to remain. The only foreign European vehicles to be retained are the Italian Fiats, these being the 15-20 h.p. touring chassis, the 20-30 h.p. touring chassis, the 1½-ton truck and the 4-ton truck. Seven American makes are retained. They are the Ford, White 2 and 3 tons, Jeffrey ambulance, Nash-Quad tractors, Knox tractors, Pierce-Arrow 2- and 4-ton trucks and the American type Saurer. All other American automobiles are to be turned out for sale to the public. One of the new rules is that no touring car of more than 20 h.p. shall be retained in the French army.

French Exports.—French automotive exports for the first three months of the present year show an enormous increase compared with the corresponding period of 1919. Under the headings, passenger cars, trucks, motorcycles, bicycles, automobile tires and airplanes, the total value is \$32,401,000, compared with only \$4,881,200 for the first three months of 1919. The value of passenger cars only, whether in chassis form or completely equipped, is \$12,643,400, compared with \$128,600 for the corresponding period of 1919.

These figures would indicate that France is already exporting as many automobiles as in the year preceding the war. In 1913 the total value of passenger-carrying automobiles sent out of France was \$43,400,000. This year, if the rate for the first three months is maintained, the total value of exports will be \$50,573,600. As it is well known that not 50 per cent of the French automobile factories are yet in production on passenger cars, the figures given above seemed open to criticism, and even the French Automobile Chamber of Commerce

doubted their authenticity. When the matter was brought before the Government Department, however, the statement was made that the figures were correct and official. It should be remembered that car values are 100 per cent higher than before the war.

Safety of Airplane Flight.—Some striking figures demonstrating the safety of flying are now available in regard to the pioneer airways between London and the Continent. The two chief services have been the Airco and the Handley-Page. The total distance flown by the machines of the former from the inauguration of the London-Paris service on August 25, 1919, until May 23 last, was 149,275 miles. Only one serious accident was recorded. In this case a pilot carrying mails, parcels and one passenger struck a thick and unexpected fog over the Surrey hills and collided with a tree, both the pilot and the passenger being killed. On the Handley-Page services the total distance flown up to May 22 was 107,417 miles, without a single accident recorded involving death or injury to passengers.

It would, of course, be foolish to make too much of these statistics, for until commercial flying is better organized than it is at present certain elements of risks will remain. For example, there is need for wireless telephone communication as a matter of routine between pilots and a series of ground stations to lessen any danger through unexpected weather conditions and from sudden developments of local fog.

French War Production.—During the war, the French automobile industry produced 56,000 airplanes, 3,000 flying boats and 100,000 aviation engines. In July, 1914, France had only 127 military airplanes, and 8 flying boats. At the armistice, she possessed 11,760 airplanes and 1264 flying boats. The number of military pilots increased from 1718 in 1914 to 18,314 in November, 1918.

In 1914 the highest speed attained was 80 m.p.h. In 1918 the Gourdon monoplane had attained a speed of 149 m.p.h. In 1914, a Morane monoplane had climbed to 6560 ft. in 12 minutes. In 1918, a Nieuport biplane had reached the same height in 4 minutes 31 seconds. The highest ceiling obtained in 1914 was 13,100 ft. At the end of the war, the Nieuport 29-C1 had increased this to 24,900 ft.

Immense progress was made on the basis of load carried. With fuel for three hours and a couple of persons aboard, the Voisin had a range of action of 60 miles in 1914, and carried 220 pounds useful load. At the end of the war the Caudron C-23 had a range of action of 780 miles. The most powerful engine in 1914 did not exceed 130 h.p. In 1918 the most powerful engine in regular production was the 700 h.p. Fiat, and the 1000 h.p. Lorraine-Dietrich was ready for production. The greatest distance covered with two persons aboard increased from 300 miles in 1914 to 1000 miles on the Breguet 14-B2 in 1918.

Calculation of Low Pressure Indicator Diagrams

A REPORT containing a theoretical study of the pressure variations in an internal combustion engine cylinder during the low pressure part of the cycle has been published by the National Advisory Committee for Aeronautics, as report No. 50.

It is assumed that the rate of flow of air and burnt gas through the inlet and exhaust valves respectively may be calculated from the manifold pressures, the cylinder pressure, and the valve clear openings by the ordinary formu-

las for steady flow through an orifice with the aid of determinable coefficients of efflux. Differential equations for the rate of change of pressure in the cylinder during the exhaust and suction strokes are set up. A method for the graphical integration of these equations is indicated. Efflux coefficients taken from the experiments of Lewis and Nutting are used in the application of the theory to a typical engine, and a theoretical low pressure indicator diagram for this engine is obtained.

System Is a Means of Harnessing Full Capacity

Mr. Tipper points out in this article the danger of over-emphasizing the importance of system. It must be considered in relation to human as well as mechanical development. Systems are static and can be changed only through rearrangement, while human beings grow and develop.

By Harry Tipper

REFERENCE has been made in these articles to the lack of bibliography on industrial organization from the human side. Organization has been considered almost entirely from the mechanical side, the rapidity and complexity of the mechanical development has emphasized the importance of the machine and the method to such an extent that the human being has been considered only in relation to this mechanical development. It is only within the last few years that any books have appeared of importance dealing with the subject of industrial organization as a matter of human relations, and even now, there is a constant tendency to enlarge the importance of the mechanical developments of the systems and methods and to minimize the importance of the psychological side.

It develops, therefore, that even on the question of industrial relations and management, a great many of the books concern themselves almost entirely with the systems and methods for the operation of organization, until this or that system of work, and this or that development of functional organization becomes a panacea for many ill defined and vague disorders which affect all branches of the organization of industry. This is not particularly true of manufacturing organizations, it is just as true of sales and commercial organization work, and in fact, the analysis of these branches of the industrial organization has not proceeded as far as the manufacturing investigations have been carried.

Organization consists of the proper grouping of people, methods and equipment for the performance of a given piece of work with the maximum of accomplishment in the minimum of time and effort. Individuals are arranged according to training or capacity, and methods or equipment subdivided and designated so that the work can be accomplished with the least confusion and the greatest speed.

Methods and equipment are static things; they do not grow or develop themselves; they can be changed only by their rearrangement through the introduction of new elements or new units in either case. The individuals comprising an organization, however, grow individually either in their capacity, their desires or their ambitions or else in all of these, and the orderly organization must take account of this human development if it is to accomplish its purpose with the maximum efficiency and the least interruption.

A few days ago at luncheon with the representatives of two large combinations in different fields of industry, a question of sales policy brought up the question of effi-

ciency. One of these large combinations manufacturing a staple commodity of standard grading had recently absorbed several smaller manufacturing establishments. The question of sales policy which was brought up related to the continuance of the brand of goods previously sold by the small establishment recently acquired, or the absorption of this business under the regular brand put out by the big concern.

The man who was talking about the problem, the sales manager of the concern, mentioned the fact that the smaller institution had sold its product at a lower price than that which was required by the large combination for the same goods. The question was put to him, "how is it possible for a small concern with its limited facilities to manufacture goods and sell them at a lower price than your concern which has enormous facilities and controls most of the business?"

The sales manager's reply was in substance, "as a matter of fact, we have grown so large that our human efficiency is not as great as it was in the establishment we have acquired."

This is true in connection with many big organizations, and there are two very important reasons for the defects.

As an organization becomes larger, the very size divides its work into so many departments and its operations have to be supervised by so many people of divergent habits of mind, that the systems tend to become more rigid and to assume an importance which constantly limits the capacity of the supervisor to exercise his judgment in individual cases and to modify the action of the system in these particular items.

The departments themselves are so large that they tend to obscure the vision of the supervisors, and to limit them to the extent of their own departments, while the subordinate workers have no conception of the ultimate object of their operations. The technical system, therefore, becomes more and more absolute, and any departure therefrom becomes the occasion for a routine of investigation, developed into a system just as formal as the mistake it is supposed to correct.

When a customer decides that his product is not as specified, he has decided to buy elsewhere, before the slow routine of investigation has established the responsibility and corrected the difficulty. In some organizations this system has grown to the point where correspondence as to the disposition of the charges between two departments of the same company have resulted in an expense of time and effort greater than the whole original charge.

This initial difficulty of the tendency for mechanical system to fossilize until it appears to be the

most important part of the organization indicates also the second important reason for the lower human efficiency of the larger organization. That is the lack of initiative among the minor supervisors and the department officials and among other brain workers whose most important accomplishment for the organization depends not upon their operations only, but upon their application of their judgment to these operations.

The routine for the investigation of ideas and suggestions has a tendency to become just as fossilized as the rest of the system, and the average man is discouraged from exerting initiative, before the matter has been finally passed upon by the methods which must be adopted in consideration of it.

There is no personal contact between the management of the concern and these employees; there is no real understanding of the necessities and objects of the company. The importance of the individual operation is minimized in the minds of the man who is governing it and the bulk of the employees, brain workers as well as hand workers, are in the grip of a system which is so little understood that it is of more importance than they are, and they are entirely limited by it. Although these effects are visible only in the organizations which have grown so large as to become humanly unwieldy, the tendency is clear in all organization work if the individual establishment is carefully examined. In a company which employed about 5000 men at the time, scattered in different parts of the United States and in a business where the processes are not very intricate, the establishment of an employees' house organ resulted in a new census of employees by the house organ editor. Each employee is required to sign a subscription blank for the publication, stating his work and his department. Over 30 per cent of the employees did not know in what department they were working, and a considerable percentage were not quite clear as to the definition of their particular job. In an organization of 500 so much emphasis had been laid upon the necessity for punctuality that the employees made it a point to be there on time, even though they were obliged to spend a number of minutes getting ready for work after they arrived on the job. In fact, employees of that concern have been known many times to go out for breakfast during the morning rather than be late.

Even the employers are not always free from the idea that the mechanical system is more important than the human attitude of mind toward work. One employer was satisfied that he had saved ten minutes a day, of the time of all the smokers of his office, by introducing a rule eliminating smoking—but a later investigation proved that the workers were going out of the office more frequently in order to smoke, consuming just as much time if not more. Naturally these illustrations represent the unusual cases.

In most organizations the devotion to system is not so visible and requires a more patient investigation. In a few organizations, however, it is thoroughly understood that because human beings grow in their capacity, desires and aspirations, system can never be anything more than the subordinate arrangement for the proper co-operation of these individuals, and if the limitations become too exact or severe the more intelligent workers will drift away from those operations and be replaced by the less intelligent.

One of the statements made by the international council in its arguments for immigration encouragement, asserts that industry can not continue at its full efficiency

without an influx of new labor from other countries constantly; and the shortage of unskilled labor is pointed out as one of the evidences of this. There are better evidences in the constant change which has occurred in manufacturing establishments, where the original intelligent craftsmen of American origin have been gradually replaced by Irish, German, Italian and Eastern European workers in the order named. The replacement has been taking place, because, as the work became more strictly limited and its routine more strictly defined the intelligent workers have moved into new fields, leaving this work to be operated by the less intelligent. The same thing is true in some of the commercial branches of business, although it is not so acute nor is it so visible in these cases.

Nevertheless, the effect of the enlargement of mechanical systems of organization in the commercial end of business has been more serious because the equipment is only a small percentage of the total requirement of any work, and a much larger percentage of its possibility depends upon the individual skill, initiative and judgment of the individual worker. Some of the psychologists have stated that the average man gave less than 50 per cent of his potential intelligence to his work. It is the harnessing of this 50 per cent of unused intelligence which is necessary to increase the organization efficiency in the face of present and future conditions.

This can not be done until the human factors which enter into the accomplishment of organization work are studied with at least as much care as the individual machine operations are studied and defined with a reasonable degree of exactitude. They can not be secure unless the system and method are regarded as flexible means of harnessing the full capacity and not as the limiting definitions of the requirement.

In many of the jobs to which manual labor is devoted, the mechanical equipment is supposed to govern the individual capacity sufficiently to be a large percentage of the total possibility of the job. Even in these cases, however, two shops in the same town show a difference in production of almost 50 per cent with practically the same machinery on the same kind of work. In the commercial end of business, however, the equipment is of much smaller importance, most of the skill is still with the worker and not with the equipment and the possibilities of the work lie much more largely in the harnessing of the full intelligence of the worker on the accomplishment of the job.

Experiments which have been made indicate that there is plenty of room for a more careful consideration of the human element in the mechanical processes of the manufacturing, but the commercial side of the business offers a vastly greater opportunity for a study of this kind and the results in many of these cases will not be limited to a 25 or 50 per cent increase, but can be made to show even 100 or 200 per cent increase with the proper study and patient consideration.

Highway Contracts

THE State of Wisconsin has prepared standard estimate forms for highway contracts. These forms have been worked out very carefully to include the actual cost items and are required for all bids. Formerly a contractor making a bid for grading work would estimate the cost per yard removed and add a profit. Under the new system he must estimate the various cost items such as labor, depreciation, etc. The forms are very complete and require a real knowledge of the cost elements of the business.

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Airplane Experimentation

THE engineering value of high altitude flight and the problems involved have recently been stated in an interesting manner in a news letter of the Army Air Service, the remarks coming in connection with further details concerning the exploits of Major Schroeder at Dayton. The difficulties in connection with the engineering division tests were summed up as follows, these constituting some of the problems connected with high flying:

"Obtaining a means of keeping the air and gas mixture ratio of the carbureter constant throughout a wide range of altitudes.

"The difficulty of delivering fuel to the carbureter against varying pressure.

"The difficulty of cooling at high altitudes and the rising boiling point of water.

"The problem of providing a drain valve to let the water out of the radiator at high altitudes in case the engine stopped, so that the cooling system would not be ruined by the water freezing."

Another difficulty was the fact that pre-ignition was encountered in the use of a supercharger due to the fact that the air delivered to the carbureter is at a very high temperature. A special instrument had to be designed to enable the pilot to control easily the supercharger pressure in the carbureter.

These problems are all vital to airplane development. They are engineering difficulties that can be overcome only by study, research and experimentation. The necessity for solving them is apparent in any consideration of the military and commercial aspect of aviation.

Numerous questions face the aeronautical engineer. The metal plane is yet to be put into production in America, as one of the ideas clamoring for attention. But it is only one of many.

Consequently, the threatened stoppage of production and close-down of American airplane factories assumes a larger significance than that of the dollars and cents involved. It means a cessation of experimentation and development, except within the government itself, and it would deprive the entire automotive industry of a great source of knowledge and experience.

Two Thoughts on Foreign Trading

THE hold that the American-made automobile is obtaining in some of the export markets in the world is summed up as follows in *The Motor Weekly*, a publication in Bloemfontein, South Africa:

"One has only to look around at any show or in any town in South Africa to see how the American measures have been justified by results. They have not only retained their own markets but maintained and enlarged those they captured during the war overseas. Unpleasant as it may be to say so, the British manufacturer must realize that there is not enough sentiment in this country to balance the hard fact that the American vehicle is cheaper than his has been in the past and that it has been proved by experience to be just as good for our conditions."

This tribute to the sales ability of the American factories is not reproduced because it is a measure of praise to those companies that have justified such a statement by their meritorious salesmanship and service in that far-away territory. It is repeated here for the two-fold purpose of pointing out what may be accomplished by the careful cultivation of an export outlet and as indicating a sales field for further American automotive products.

A high order of service must be maintained in connection with South Africa. Any company seeking to expand into that section of the world must recognize that it cannot go in haphazardly and without an intelligent and permanent policy. Likewise, those firms already in must "keep up on their toes" in all matters that pertain to such selling. That is the first thought.

The second concerns the sale of tractors, accessories, trucks and other automotive products. The trail is blazed for the American product. It should be followed up and not forgotten.

Success and Bricks

NOW that the feared business crisis has been succeeded in the daily newspapers by the political crisis, it is interesting to look back on the comment of some days ago and to review them briefly. After the outlaw railway strike, when attention was focused on transportation, it appeared to be rather a popular sport for financial writers and others contributing to the daily press to throw bricks at the most conspicuous target.

Success always becomes a target, if the success is sufficient to raise the head of an industry above the common level. Just now, the automotive industry stands out as the largest manufacturing industry of the day. It has gained its momentum more quickly than the older industries and stands head and shoulders above the older and more conservative lines. As a result, a good many bricks were thrown at this particular head. Let us consider some of these slams. Here are a few:

The automotive industry is taking so much of the steel that the farmer cannot get nails, the builders metal lath and the railroads the steel for cars and locomotives. The estimates of consumption ran up 40 per cent of the total production. But the editor of *The American Metal Market* has checked up this report. He states that, taking the most liberal estimate of automotive production, the industry uses less than 10 per cent of the steel, his own estimate placing the amount at 6 per cent.

There was the charge that the automotive industry monopolized the freight transportation facilities. Now, stop and think. There are probably 800,000 trucks in use in this country—all engaged in moving traffic. They must give at least some assistance to the sorely-burdened rail transportation facilities. A familiar newspaper headline has been the one that told how factories were kept going by the use of motor trucks to bring in materials.

Everybody read that the automotive industry was monopolizing labor by the simple process of paying more money. But, stop a moment. During the steel strike, we heard that the steel men were the best paid in the world. This is admitted, so the steel mills were outbidding the automotive factories. We heard that our industry had robbed northern Michigan of miners and farm laborers. The truth is that the copper mines are dull because copper is a drug on the market and that most of the men had to go elsewhere for work. In fact, the copper miners who are at work are paid wages that compare favorably with any industry except steel. In New England, the automotive manufacturers and the men who make tools for automotive factories will tell you that the textile industry has been outbidding them for labor. The textile industry once was almost at the bottom of the wage list, but that low position has changed. The price of cloth explains this. As to farming generally, any farm investigator will tell you that automotive products have done and are doing more to keep labor on the farms than any other agency. Also that the truck, tractor and passenger car are highly valuable assets to the farmer and his big trouble is that he cannot buy the vehicles he needs.

We heard that the automotive industry was using all of the copper. In fact, the great need of the copper market was to get somebody to use the metal. Our industry did its best, but it was excelled in quantity by the seldom-considered washing machine.

Now turn the situation around and see what happens: Begin with the scarcity of building material charge. After the armistice when everyone wanted someone to "carry on," the automotive industry did that very thing. Without waiting for legislation or a peace treaty or a favorable ruling from the financial powers, the automotive industry

jumped in and put the wheels to moving. Many enconiums were heaped upon the industry as a "stop gap" power. It bought the building materials that no one else wanted and put many men to work building factories. But later, when the timid ones entered the field, there was a cry that the automotive industry was "grabbing the farmers' nails," also that it was taking the metal lath from the urban builders. As a matter of fact, when this cry arose the most conspicuous building operations in the cities were theaters. We leave the choice to you. But consider a moment. Did you ever compare the steel plates on the body of an automobile with metal lath?

Now as to the automobile and high prices. The increased prices of automobiles are very mild as compared with most other products. It is difficult to give exact figures, because the product is constantly changing for the better and the car of one year is not the car of another and they cannot be judged by weight or other fixed measure. But let's look at the method of marketing. An automotive manufacturer designs his vehicle, obtains his cost data and then adds his profit, the total making up the price. It is practically a cost-plus basis.

Then turn to the lines that have been accusing the automotive manufacturer. Steel and other metals, as well as building materials, are marketed on the "get all the traffic will bear" system. The question is not: "What did it cost?" but "How much can we get for it?" All of these basic materials markets are on the public bidding system and, when the price runs down to cost, the mills shut down and lay off their labor.

In the end, we would like to assert again, the automotive industry is a transportation industry and its record of fearlessness and of overcoming difficulties stands second to none.

Commerce Chambers Boom Trucks

Give Transportation When Need Is Great Indispensable Not Only in Con- gested Urban Districts, but in Country Also

Chambers of Commerce throughout the United States, not only in the smaller cities but in the larger ones as well, have become enthusiastic boosters of the motor truck. Its value as a transportation medium between terminals and in congested districts has been established so often that it is an old story. Business men frankly confess that they do not know what they would have done without it in the trying times of the past few months.

Not only has the truck become indispensable in the cities but it is rapidly making itself invaluable for short hauls to and from the industrial and gardening districts surrounding all urban communities. Last week AUTOMOTIVE INDUSTRIES told the views of railroad executives on trucks. This week it presents the opinions of some of the larger organizations of business men on the same subject.

Real Help To Nation Seen in Milwaukee

MILWAUKEE, June 19—There is no room for argument about the need for development of motor truck lines as feeders for the railroads and for short hauls of less than car load lots in congested districts, in the opinion of Phil A. Grau, business manager of the Milwaukee Association of Commerce.

"The transportation condition of the country is such," he said today, "that every available medium which will tend to lighten its burdens should be immediately and constantly developed. It is my understanding that the railroads themselves would welcome motor truck lines as feeders and also for the purpose of short hauls of less than carload lots in certain districts where congestion makes the traffic problem acute.

"Therefore, with their cooperation there should be no doubt as to the future of such motor truck lines from a business standpoint. Apart from the element of personal gain to anyone who may be financially interested in motor truck transportation—which is perfectly legitimate—there is an element of service which such lines can render to almost every community in the United States.

"While it is true that there may be some lines of industry which cannot avail themselves of motor truck transportation there are many to whom it will be welcome. The business men of the country, no doubt, will be glad to see such service established.

"Every one who can intelligently advance the motor truck transportation industry should do so at once. Unfortunately, we have a habit in a good many American cities to wait for something to happen instead of going out and creating it.

"Motor truck transportation will not be wafted to us on the fumes of gasoline, nor will it spring into existence overnight from one spark plug to another. Somebody has got to get out and go after it. If this is done the transportation difficulties that will be aided, and in some instances solved, within the next ten years, will, in my opinion, surprise even the most sanguine motor transportation enthusiast.

"My word to any and every one who is interested in increasing motor truck transportation is: God speed you!—Good luck!—More power and more business to you!"

Carriers Say Trucks Are Great Assistance

PHILADELPHIA, June 19—The Philadelphia Chamber of Commerce is deeply interested in the co-ordination of motor trucks with the railroads as a means of facilitating transportation of needed commodities. Representatives of the leading steam lines here, some of whom are members of the Chamber of Commerce, have expressed their willingness for motor trucks to act as feeders to the railroads for hauls up to twenty miles, asserting that this would not be competition but genuine assistance as it hardly pays the roads to handle this class of business, because of the heavy terminal charges.

When, however, the chamber's commissioner of transportation, George P. Wilson, requested the roads' representatives to obtain from their chiefs a statement to that effect in writing, there were no results. It is hoped, however, to resume negotiations, as the chamber is fully in favor of trucks acting as feeders, at least for the short haul of twenty miles or under.

Cincinnati Sees Need For Better Highways

CINCINNATI, OHIO, June 19—The Cincinnati Chamber of Commerce is convinced that the short hauls from 50 to 75 miles belong to the motor truck and is working unanimously for the development of this service, according to the Transportation Department. Merchants of the city are finding the speed with which goods can be delivered by motor truck to neighboring towns is so much greater than shipping by rail they will never go back to the railroads on the short hauls, it is stated.

(Continued on page 1480)

St. Louis Fostering Shipment By Truck Chamber of Commerce Tries to Find Return Loads—Ends Delivery Quickly

ST. LOUIS, June 21—The St. Louis Chamber of Commerce through P. W. Coyle, its traffic commissioner, is doing everything within its power to develop motor truck lines for the handling of less than carload shipments into the St. Louis trade territory within a radius of 100 miles. Not only does the Chamber put the St. Louis shippers in touch with the 14 available motor truck routes operating on a regular schedule and others operating without a regular schedule, but it endeavors to find loads for return trips.

"The motor truck is of inestimable value from the standpoint of efficient handling of less than carload freight on hauls of 100 miles or less," said Coyle. "Railroad shipments frequently require from two to three days to reach their destination within this radius; the motor truck delivers the freight the same day.

"The beauty of the motor truck is that it is a store-door to store-door proposition, eliminating the hauls from the store door to the freight depot and again from freight depot to store door. The territory within the radius named belongs to St. Louis and it can serve it best by motor trucks. As it is now, the railroad service is better to Kansas City or Chicago than it is to points 25 or 30 miles from St. Louis."

Coyle said that the question of the motor trucks as feeders to railroads was not a problem for a large city such as St. Louis, but he recognized their value for the smaller cities.

GEORGIA LINES UP ROAD WORK

ATLANTA, June 21—Under the supervision of the State Highway Department more than \$2,000,000 worth of road work has been completed in Georgia during the past year, and more than \$7,000,000 worth is under actual construction at the present time involving 143 contracts, according to the annual report of the State Highway Board submitted to Governor Hugh M. Dorsey. This board was only organized in September, 1919, and though less than a year old it has accomplished more in good road building in Georgia than any other single factor.

This report comes to public notice with peculiar interest at this time for it follows immediately upon the heels of a decision of the courts that the state highway law passed by the last legislature, under which the board was organized and is now operating, is null and void by reason of a technical defect in the passage.

Luxury Propaganda Injuring Industry

Smaller Companies Face Possibility of Being Forced Out of Production

NEW YORK, June 21—All the financial interests in New York which are representative of the automotive industry have taken up seriously the questions of bank credits. In the first place they seek to benefit the industry as a whole, and in the second place they seek to protect themselves. Credit is becoming every day a more serious question.

The propaganda which has been carried on to make the banks and other financial interests feel that passenger cars are non-essentials and therefore luxuries, is bearing fruit. It has reached a point now where some of the smaller companies may have to go out of production unless there is an easing of the strain. Although they may be on the soundest basis they are bedeviled by the banks and by merchandise creditors.

The parts makers from whom the manufacturer buys have a credit problem of their own and they are trying to meet it in a sane and broad-minded way. They must protect their own interests, but many of them are coming to feel they must grant more liberal credit to customers who are good risks and who always have paid their bills promptly in the past.

Automotive interests have determined to convince their individual bankers that automobiles are essential and that it is dangerous to curb another element of transportation when transportation never was so much needed as now. They believe that if individual bankers here and there can be shown the essentiality of the industry the facts of the case gradually will percolate through the entire financial structure.

Financing companies are having their own troubles. Many of them have had their own lines of credit curtailed and therefore, at a time when the demands of dealers are heavier than usual, they are able to give less accommodation. To extend their lines to new banks they are selling the industry to bankers.

Many dealers have grievances, real or fancied, against finance companies, but the finance companies have a grievance against certain dealers whom they accuse of unscrupulous business practices. As a consequence their credit men recently have organized the Automobile Credit Men's Financing Association, Inc. This organization has established a clearing house for the protection of the members.

One of the evils cited by finance companies is that certain dealers induce car purchasers, ignorant of business practices, to sign two or three notes. These notes are then taken to two or three different finance companies and money obtained on them from each. A record of every piece of paper bought is filed at the clearing house and these cards are

scrutinized carefully. This is expected to put a crimp in the dealers who have been guilty of unethical practices and thereby conserve credit.

The finance companies are not pleased with the attitude assumed by many banks. They contend, for example, that the note of a reputable automobile dealer is vastly better security than a trade acceptance. They point out that in many cases it is backed or indorsed by the manufacturer. It also bears the indorsement of the dealer himself and the finance company. When it goes through a bank of deposit it has that bank back of it, and still Federal Reserve banks are refusing to rediscount this paper, although all of it is secured in the last analysis by the commodity sold.

Federal Foreign Bank Opens Doors to Trade

NEW YORK, June 21—The first Federal banking association, the pioneer foreign banking institution organized under the recent Edge act, opened its business to-day in its offices at 40 Wall Street. As comprehended under its organization it will engage solely in financing American foreign trade, under the presidency of Arthur H. Titus. Its capitalization is placed at \$2,100,000.

"The credits required include the ninety day drafts to which many American exporters have become accustomed and, in addition, there is an increasing demand for credits of six to nine months and longer," its opening statement declares. "The present situation in Europe gives rise to special credit problems. European customers ask for long terms, to assist rehabilitation of solid and going enterprises. The association is organizing facilities for discounting drafts and making acceptances fitting the broadest service that international merchandising requires. These facilities will be available to the general business community."

TO STANDARDIZE GAGES

NEW YORK, June 21—A sectional committee of the American Engineering Standards Committee has been organized to undertake the standardization of plain cylindrical gages for general engineering work. The work will be undertaken at the request of the British Engineering Standards Association. It is understood the committee will recommend that the scope of the work be enlarged to include all plain limit gages for general engineering work. The committee is headed by E. C. Peck, general superintendent of the Cleveland Twist Drill Co.

LITTLE RECEIVERSHIP STANDS

DALLAS, June 19—A motion asking dissolution of the receivership over the Little Motor Kar Co., has been overruled in a local court. The motion was filed on behalf of stockholders claiming to control \$250,000 worth of stock. A few days previous to the filing of the motion the stockholders met and named new trustees for the company.

Trademark Pirate Assigns His Rights National Chamber Succeeds in Effort to Restore Registra- tions to Owners

NEW YORK, June 22—Through the combined efforts of the National Automobile Chamber of Commerce, the State Department and the American diplomatic representatives in Portugal, a settlement has been arranged and concluded with Manuel de Silva Carmo, whereby he individually assigns his applications for registration of automobile trademarks which he attempted to pirate, to each American owner in return for what he represents to be his costs. Cable advices just received report the signing by Carmo of the proper documents to put these trademarks into the name of the American manufacturers of the cars they identify.

"The difficulty and expense involved in conducting a lawsuit in a foreign country rendered it advisable to accept the proposition which Carmo was finally induced to make, although the litigation would probably have been successful," said Albert E. Parker of the International patent firm of Marks and Clerk, who handled the matter.

Mr. Parker explained that the 1920 United States trade mark law removes the difficulty which has formerly existed in connection with some of the so-called pirate countries which require applications on behalf of foreigners to be based on a corresponding home registration. The new act establishes a special register of all marks not registrable under the principal law, which have been used for at least a year. Those trademarks open to objection as being descriptive, geographical or surname under our system of trademark jurisprudence may be registered in this country and also in most foreign countries without delay, so that the former impediment to the proper registration of such trade marks abroad no longer exists.

Western Makers Seek Latin-American Trade

LOS ANGELES, June 21—Theodore Hobgood has returned, after being in Central and South America for several months in the interests of the Moreland Truck Company. Hobgood made a study of motor truck possibilities in Mexico, Guatemala, San Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, Peru, Bolivia and Chile. He asserts that shipping conditions on the Pacific Coast are better than those in the eastern part of the country and consequently the manufacturers here are in a better position to obtain business.

Hobgood says that trucks are being used under the severest conditions in South America. He declares they are being required to carry enormous loads over almost impassable trails. The difficulty in getting replacement parts is one of the chief handicaps to truck sales.

Railroad Situation Shows Little Change

Industry Not Helped with Shipments But Supply Deliveries Improve Slightly

NEW YORK, June 21—No improvement is apparent in the transportation situation so far as it relates to the shipment of automobiles, at least. There has been a slight easing, however, in the strain of getting supplies to factories although there is no possibility of accumulating a reserve stock of materials to tide manufacturers over the fall when crop shipments are in full swing.

Lack of transportation is the most alarming phase of the present industrial problem. It is more serious than the credit tension upon which it has had an important bearing. There is no prospect of material relief. The accumulation of freight cars has been cut in half since the Interstate Commerce Commission began untangling the jam on the railroads, but when equipment is devoted to the movement of the new crops there will be a more pronounced shortage than ever. In this connection not more than half the old crop of wheat in Kansas has been taken out of the elevators and warehouses and the new harvest is only a few days away. It already is under way in some of the great wheat growing sections.

The Interstate Commerce Commission has taken up the representations made by the National Automobile Chamber of Commerce in reference to the shortage of automobile cars. It was pointed out that instructions regarding the movement of this type of equipment has not brought results and that the refusal of other equipment for the shipment of automobiles, therefore, is unfair. The commission has been informed that automobile manufacturers drove away from their factories in April the equivalent of 17,000 freight car loads of automobiles in July and that they are adopting every possible expedient to relieve the carriers and thus aid other shippers.

Refusal to supply open cars is having a serious effect on the shipment of motor cars for export and this situation has been called particularly to the attention of the commission. Every effort will be made to gain better recognition of the automobile car and the reasonable use of open cars.

Another menacing problem which confronts not only automobile makers but manufacturers in every line is an impending coal shortage. Reserve stocks are exhausted and many factories are already running on a hand-to-mouth basis. Conditions are similar to those which usually prevail in the middle of the winter. Dealers, with the books filled with orders, are unable to make deliveries.

The Federal Reserve Board, in a review of general business conditions for May, calls attention to the fact that there is likely to be a shortage next win-

ter which may curtail production of iron and steel and may seriously affect other industries. Production of coal is being curtailed, largely because of the shortage of cars. The car shortage is held to be due in considerable measure to labor difficulties.

An additional manufacturing complication which may arise is the possibility of independent steel manufacturers in the Youngstown district closing their mills after the expiration of the present wage scale on June 30. Employers and union representatives have failed to agree on a new scale and the workers have refused to resume the conference before September. Wage increases demanded run in some cases as high as 33 1/3 per cent. If the independent mills shut down it will have a serious effect on the automobile industry for many manufacturers are dependent upon them for their sheets.

Symington-Hoffman Buys Trego Motors

NEW HAVEN, June 19—The plant and assets of the Trego Motors Corp. have been purchased by the Symington-Hoffman Co. of Baltimore and New York, which a few months ago bought the Rochester Motors Co. The complete tool equipment of the Trego plant is being shipped to Rochester to equip the large addition which the Symington-Hoffman Co. already has made to the factory of the Rochester Motors Co.

The Rochester plant will be in active production on two types of motors—the Rochester-Duesenberg 4-cylinder high speed automobile motor and the model 100 Trego 6-cylinder engine, the latter going into production late this fall. A production of 10,000 Trego motors is planned for 1920. N. G. Rost, vice-president of sales of the Rochester Motors, will have charge of sales of both types of motors. His headquarters are at 120 Broadway, New York.

The 2-cylinder marine engine designed by the Trego corporation will be sold by the new owners as they do not expect to manufacture it themselves.

DISMISS WIRE WHEEL CASE

BALTIMORE, June 19—The Federal Trade Commission has dismissed the case against the National Wire Wheel Works, cited for alleged unfair competition. This grew out of an advertisement, Feb. 13, 1919, in which the word "patented" was used in connection with these features of Pasco wheels:

1. Stronger web with more crossed spokes.
2. More dependable hub cap—impossible to strain or break.
3. Safety locking device—giving greater safety.

Patents had been applied for, and the manufacturers, upon advice from the commission, refrained from further statement that the features had been patented. National and Pasco wire wheels are now being manufactured by the Maryland Pressed Steel Co., of Baltimore and Hagerstown.

Los Angeles Fights Closed Shop Move

Factories and Garages Prepared to Close if Necessary to Defeat Unions

LOS ANGELES, June 21—There is a well-defined movement here among automotive mechanics to bring about closed shop conditions. Makers, dealers and garage owners are aware of the situation and will combat it to the extent, if necessary, of closing their establishments rather than submit to unionization. This is an open shop city in almost every line of labor and nothing so alarms employers as activity on the part of union agitators to bring about the closed shop.

A meeting of 100 employers representing the automotive industries was held and at that time it was disclosed that union representatives have come here recently from other coast points with the avowed intention of establishing a union among the mechanics. Union meetings have been attended by secret service representatives of employers and to date nothing has been accomplished by the agitators. The present whereabouts of the agitators are known and they are being subjected to careful watch.

Some semblance of trouble has appeared in several of the garages. The plan of the union workers is to accomplish their purpose by word of mouth solicitation. Their one idea, it seems, is to obtain a 90 cents per hour scale regardless of class of work. Under the open shop principle employers are paying their mechanics according to what they deem them worth. Labor conditions here have been among the best in the country for mechanics and undoubtedly the unions will strike a very pronounced snag in putting their plans into effect.

WOOD BUYS MILWAUKEE PLANT

DETROIT, June 19.—Gar. Wood has taken control of the Horizontal Hydraulic Hoist Co. of Milwaukee and will continue operation of the plant in that city. The Milwaukee plant will be operated independently and its management will be in the hands of Logan Wood, who has been elected vice president and general manager. Gar. Wood will continue in active charge of the two plants here.

ADVANCE RUBBER TO MOVE

NEW YORK, June 19.—The Advance Rubber Co., manufacturers of Top-Notch tread tires, soon will occupy its new plant 21-33 Gardner avenue, near Flushing. The plant consists of a one-story steel and brick factory and a two-story office and salesroom. The site is 200x130 feet. The production capacity will be three times what it is at present.

The company expects to make a cord tire as well as its fabric tire and hoof pads. Demand for tires from its Los Angeles branch made expansion virtually necessary.

South Africa Keen for American Cars

Trucks and Tractors Coming Into Wide Use—Special Designs Required

JOHANNESBURG, SOUTH AFRICA, April 28 (*Special Correspondence*)—William Campbell, who has just recently returned after being absent in England and the United States for many months, and who is one of the large handlers of American lines in South Africa, has been most impressed by the real development of this country, due to the war. The war has caused more advance than many years of peace in that it compelled the country to depend upon its own great sources of wealth and encouraged local production in foodstuffs together with manufactures.

To-day her vast store of mineral wealth of all kinds is being exploited as never before. Instead of being, as hitherto, an importing nation, last year showed the balance to be on the other side. Exports more than balanced the imports by over £340,000 and this does not include the production of gold (all exported) which accounts for a further £36,000,000 to the good.

South Africa is therefore a creditor amongst the nations of the world and it is a sore point with our merchants that to-day she should suffer equally with others in a depreciated currency to the detriment of our trade with America. Happily the exchange has been steadily moving towards something nearer the normal so we look for a better demand in American products in the near future.

English competition in automobiles may be said since the war to be unknown in this market. Factory prices are so high that but for a few cars such as Vauxhalls, very few have been imported. Strenuous efforts are, however, being made to recapture the market and there will be a certain sale amongst those who have a sentimental regard for the products of England. Otherwise high-class American cars have firmly established themselves on the market both for quality and dependability.

Automobile Demand Strong

Nothing has, however, stopped the demand for automobiles which has, in the past year, been abnormal and sales have been almost entirely on American makes. Here, as in the rest of the world, the automobile has passed from being simply the vehicle of pleasure to being a business necessity. So great lately has been the demand that now practically all the better American makes are represented on the market, among the newer comers being the Chandler, Cleveland, Haynes, Nash, Liberty, and now we hear that supplies of the Wintons and Elgins are en route.

Money is being freely attracted to the motor trade, commodious buildings are being erected in every town and a number of firms seem to be vying with each other as to who can most extend the

number of their branch establishments. In the more conservative circles the position is viewed with not a little anxiety. Not that there is any doubt as to the future of the automobile business but the fear is expressed that too much of the speculative has entered into it and that, given even a temporary set-back, many will find that their capital is not adequate to their carry.

Gradually we are seeing a steady increase in the demand for motor trucks and whilst in former years sales have been confined to those of British manufacture the past year has seen the American manufacturer coming into his own.

Ideal Tractor Not Found

In farm tractors we have not yet found our ideal for South African conditions. So interested are the dealers and so great is the field open to mechanical traction in agriculture that practically every known make of farm tractor has been imported. Virtually all of them give satisfaction when working in the old well-wrought lands of the coast line and Cape Colony, but that only touches the fringe of our problem.

Our future lies with the vast stretches of land in Transvaal and Orange Free State, either as yet uncultivated or partially cultivated, where our torrential rains and the nature of the soil form a bricklike surface which offers the greatest test in the world for all classes of farm labor. Put to this test, the average farm tractor is not lacking in power but either the costs in fuel mount up so high or the tractor proves to be so balanced that it bucks.

For South African service many well-known makes would be decidedly improved if the weight were more distributed towards the front of the machine. The difficulty is also increased in that demonstrations are often conducted by men who have not studied sufficiently the whole of the problem which includes the choice of the plow suitable for the type of tractor used.

Government Supports World Search for Oil

WASHINGTON, June 19—Secretary of the Interior Payne has indorsed the bill introduced by Senator Phelan for the promotion of world-wide search for oil under Government supervision. His letter of indorsement sent to the California senator to-day points out that the authorization of a special corporation for exploration of oil fields abroad will supplement the diminishing supply in this country.

The secretary suggests certain changes in the Phelan bill to safeguard American interests and avoid international complications. It is believed here that the proposal will be bitterly fought by British interests who have been making a great effort to control world oil supply. With the increasing demand for gasoline here, the claim is set forth that importation from American companies operating in other lands will be decidedly beneficial. The bill will not be taken up until the next session of Congress.

Oregon Cultivates New Gasoline Supply

Portland Dealers Get 40 Carloads from Independent Companies —Conditions Better

PORTLAND, ORE., June 21—Gasoline shortage here is still serious, but has been relieved to some extent through efforts of Portland dealers, who have gone into the open market and contracted for delivery by rail of several hundred thousand gal. from independent companies. About 20 carloads of this gasoline either have arrived or are on way. They are being diverted at once to out-State towns where shortage is most acute.

The shortage at present is "spotty," several towns that had been almost entirely out of gasoline for two or three weeks now having sufficient so that rationing is no longer necessary, but in central Oregon, shortage is now worse than before. Portland dealers are arranging to divert carloads there.

In Portland rationing of commercial cars to 75 per cent tank capacity and passenger cars to 20 per cent tank capacity continues. There will be temporary let-up this week, due to Shriners' convention, and after this week oil companies expect to increase passenger car allowance to 50 per cent.

In their efforts to obtain gasoline, dealers have contracted with independent companies in Southern California, and have even entered negotiations with Texas companies. There have been considerable importations also from Wyoming and Idaho. The peak of the shortage seems to have passed, though supply yet is far below normal and rationing may continue for another month to six weeks. The first panic which resulted in many cancellations of orders by timid buyers has entirely passed.

Motor car sales are again nearing normal locally, though still slow up state.

AUTOMOBILES HAUL TRAILERS

WILMINGTON, DEL., June 21—The motor trailer is becoming popular in rural Delaware, particularly in the lower part of the State, where there are sandy roads and large trucks are a novelty. They are being used a great deal by farmers who are combining pleasure with business in the matter of automobile ownership. The trailers are attached to passenger cars, and in that manner produce is hauled to the towns and railroad stations and return loads are carried, while hauling about the farms is also facilitated by the use of the trailer.

HAYNES TO ADD BODY PLANT

KOKOMO, IND., June 18—Haynes Automobile Co. is soon to build a body plant as an addition to its group of factory buildings, which will have a capacity of 50 bodies a day. A dry kiln will be erected in one end of the new building where lumber for the bodies will be seasoned by steam heat.

Cincinnati Sees Highway Needs

Development of Truck Lines as Transportation Medium De- pendent on Proper Roads

(Continued from page 1476)

The advantages of store door collection and store door delivery and the promptness of getting shipments through are said to more than make up for the difference in the freight charges. The view is expressed that the motor truck affords the only possible relief for the present railroad conditions and that the advantages of the motor truck service, being developed by the present necessity, are so apparent that the system will not only become permanent but that its scope will be greatly increased.

William T. Callerdine, chairman of the Highways Committee, says the big factor in developing the motor truck routes is roads that will stand up 365 days a year under loads up to 12 tons and that the committee of which he is chairman is exerting every effort to secure such highways through Southern Ohio.

Cleveland Business Men Back of Trucks

CLEVELAND, June 19—The transportation department of the Cleveland Chamber of Commerce was a pioneer in the campaign to make the motor truck an important factor in short hauls of freight.

This department, with the backing of big business in this city, was operating a bureau in the interest of motor trucks before the truck manufacturers got strenuously busy. F. E. Baer, manager of the department, had the northern part of Ohio surveyed for routes, arranged truck schedules and maintained a return loads bureau.

"We did this because Cleveland shippers recognize the fact that the motor truck is both practical and economical for short hauls of freight," said Baer. "That statement applies to both carload and less than carload lots."

Business men interviewed on the subject pointed to the shortage of freight cars and said it created a problem in transportation that only motor trucks can solve.

Indianapolis Strives To Help Railroads

INDIANAPOLIS, June 19—That the motor truck is not a competitor of the railroads and electric lines, but a feeder for them is the premise upon which the Indianapolis Chamber of Commerce has worked to develop the motor truck as a carrier of importance to the railroads and the waterways.

With even the fine railroad shipping facilities and electric line service which Indianapolis and Indiana have, the map shows big stretches of territory not touched by these steel lines but which

can be served with the motor truck, carrying goods from city to farm and vice versa from rural district to shipping station.

Indianapolis has established a motor truck terminal which will co-operate with railroads and interurbans in every way possible to furnish better transportation but will not compete with them. The Indianapolis Chamber of Commerce, to bring this about, is working with the state transfer association, is organizing the truckers of the state and conferring at frequent intervals with the electric line men and the railroad men. The chamber has as one of its divisions a Highway Transport Department, whose business it is to develop the motor truck as a carrier, but to develop it hand in hand with other forms of transportation to get the best and cheapest transportation for Indiana.

Boston Wants Loads Sent Both Directions

BOSTON, June 19—The development of motor truck lines as feeders for the railroads and also for through deliveries of less than carload lots meets with the approbation of the Industrial Bureau of the Boston Chamber of Commerce. N. S. P. Nichols, assistant secretary of the Chamber of Commerce, said to-day:

"There is a field here for some systematized plan for return load movement but the success of it will depend almost entirely upon the reliability of the people conducting it and the reliability of the men operating the trucks. By that I mean they should carry insurance on goods in transit against fire, theft and liability for collision or overturning of loads. While a large number of the truckmen carry insurance there are some that don't and it is these we have to look out for. Since the war the Industrial Bureau here has been used as a clearing house for the shipper to get in touch with the auto men and the auto men to get in touch with the shipper."

Minneapolis Association Promotes Truck Lines

MINNEAPOLIS, June 21—The prospect of the adoption of the Babcock plan, which if approved at the November election will mean a 7000-mile trunk highway system for Minnesota in the next ten years, the peculiar railroad situation obtaining in the Twin Cities and the elasticity of the ship-by-truck plan make the development of motor truck lines of primary importance to the business men of Minneapolis, according to Sewall D. Andrews, executive chairman of the Wholesalers' and Jobbers' Section of the Minneapolis Civic and Commerce Association.

"Much of the rail shipments from either Minneapolis or St. Paul to other Minnesota points passes through the other city, a fact which injects a varying degree of delay especially with less than carload lots," said Andrews. "Minne-

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Truck Traffic Grows Fast in Louisville

Shippers Quick to See Advantage of Rapid Transportation Over Short Routes

LOUISVILLE, June 19—The Louisville Board of Trade placed its stamp of approval on the development of motor truck lines not only as feeders for the railroads, but also for short hauls when it acted as sponsor in the recent Ship-by-Truck demonstrations. Other organizations which have indorsed the movement are the Merchants and Manufacturers Association, the Retail Merchants Association and the Live Stock Exchange.

It is estimated that 500 shippers in Louisville alone are taking advantage of this method of delivering their shipments. There are eighty-eight truck operators and no less than twelve of these are operating three or more trucks. Shipments into Louisville consist of live stock, milk, vegetables, grain, tobacco and many other products of the fertile surrounding country. On their return trip truck operators are hauling groceries, dry goods, furniture, automobile supplies, etc.

The ship-by-truck movement is growing in favor rapidly with the merchants in the smaller centers who are advocating the establishment of return load bureaus in each of the larger of the surrounding towns.

Shippers in Louisville report that country buyers now specify ship-by-truck on their orders where formerly they specified freight or express. A happy feature of this change is that the railroads seem glad to be relieved of the short hauls.

The cross road is now assuming a position of importance, similar to that formerly occupied by the railroad junction, and the larger towns, such as Salem and Corydon, Ind., and Eminence, Shelbyville, Harrodsburg, Springfield, Bloomfield, and Bardstown, Ky., will develop more and more into distributing points for their respective localities.

Columbus Organizes Feeders to Railroads

COLUMBUS, OHIO, June 19—The traffic department of the Columbus Chamber of Commerce has taken an interest in the development of motor truck lines as feeders for railroads and to relieve the freight congestion. Already a number of such lines are in operation.

One of the things which has worked against this idea in central Ohio is the bad condition of the roads. James G. Young, traffic manager for the Columbus Chamber of Commerce, as well as George M. Schwartz, president of the Columbus Merchants' and Manufacturers' Association, believe the only way to prevent similar freight congestion in the future is to encourage and develop motor truck transportation.

Ohio Farmers Find Cars a Necessity

**Ninety Per Cent of Automobiles
Declared Operated on Business Basis**

CLEVELAND, June 21—The northern Ohio farmer is convinced that his automobile is a strict necessity and not a luxury. The B. F. Goodrich Co. recently made a survey in Lorain county, Ohio, to ascertain just what the farmer thought of his automobile, and the company learned that the average owner on the farm regards his car as being just as necessary as is his team of horses that does the plowing.

More than 75 per cent of the farmers questioned owned passenger cars. Each owner was asked whether he classed his car as a business or pleasure machine. Fully 50 per cent of the answers were in effect "Absolutely necessary," and "I couldn't get along without it." Of the other half of Lorain county motor car owners, 40 per cent stated that they considered their cars a fifty-fifty proposition—half as utility and half as pleasure vehicles.

Ten per cent of the farmers questioned owned motor trucks—largely of one and one-half ton capacities. Five per cent stated they were in the market for light trucks. Over 25 per cent declared a large part of their product was hauled to market by truck. Truck lines have made dairy operation profitable in Lorain county. Nearly every farm has a small milk shipping platform in front of its gate. Produce, garden truck and fruit are quickly transported to market by both passenger car and light truck, thus saving thousands of precious hours for the farmers each year.

Army Convoy Starts Cross-Continent Trip

WASHINGTON, June 21—Ceremonies in which Cabinet officials and high army officers participated marked the departure of the fifty trucks comprising the Motor Transport Corps convoy for the trans-continental trip. The cross-country tour from Washington to Los Angeles under the auspices of the War Department will be an acid test as to the fitness of various types of commercial vehicles. One of the chief studies will be the relative value of pneumatic and solid tires for trucks under all conditions of travel. The data obtained by the Government experts on this trip will figure more or less prominently in the establishment of standardized motor equipment.

Only one and one-half-ton trucks, all equipped with pneumatic tires, were in the convoy. In the tour made over the Lincoln highway last year solid tires predominated.

GUARD TO GET MOTOR CARS

WASHINGTON, June 19—Motor equipment will be issued to the sixteen

national guard infantry divisions and two cavalry division trains in accordance with an order issued to-day by the war department. The equipment will be distributed by the motor transport corps of the army when approved by the chief of the militia bureau.

The equipment to be turned over to the national guard divisions consists of the following: Cars, motor, medium 164; cars reconnaissance 160; trucks ambulance $\frac{3}{4}$ ton 784; trucks light repair 48; trucks $\frac{3}{4}$ ton cargo 277; trucks $\frac{3}{4}$ ton machine gun 112; trucks $1\frac{1}{2}$ ton cargo 484; trucks 3 ton cargo 608; trucks 3-5 ton 1344; trucks tank 48; motorcycles with sidecars 1920; motorcycles solo 32; bicycles 1280; trailers $\frac{3}{4}$ ton tank 442; trailers $\frac{3}{4}$ ton 48; trailers $\frac{3}{4}$ ton kitchen 442; trailers anti-aircraft M G 128.

Minneapolis Association Promotes Truck Lines

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apolis jobbers are coming to realize that shipments can be expedited through direct truck deliveries, this plan possessing the added advantage that the trucks on the return trip can gather farm produce and other freight for the local market and railroad terminals. Unquestionably, the development of truck lines will be a great stimulus to good roads, as winter traffic is largely contingent upon this point.

"The Minneapolis Civic and Commerce Association is actively engaged in bringing the motor truck men into contact with potential users of such a system and the ship-by-truck movement, which is just emerging from the experimental stage in Minnesota, is being watched with the keenest interest by the association and the leading firms of the Twin Cities."

Purchase of Trucks Urged By Chamber

JOHNSTOWN, PA., June 19—The Johnstown Chamber of Commerce is not only greatly in favor of employing trucks to act as auxiliaries to railroads on short hauls, and moderately long ones, but is doing all it can to push the sale of motor vehicles of all sorts, even to the extent of running at its own expense quarter-page advertisements. One advertisement in the series reads as follows:

"AUTOMOBILES? YES"

"Hearsay, catalogues and the conflicting claims of agency representatives confuse the average person considering an automobile purchase. It's a decided advantage to get firsthand information.

"Of the hundred and one present-day motor cars you see advertised, you'll find the makers showing their cars, in the various types, with the newest equipment, in Johnstown. This city is a growing center of automobile selling. If it's a car of modest price, a medium price car, or a car of highest mechanical development that meets your requirements, you can be sure that an obliging dealer is ready to give you details regarding it—in big, friendly Johnstown."

Demand Abroad to Tax Factories Here

**European Representatives Say
Entire Production Could Be
Taken, If Permitted**

DETROIT, June 19—Ford Motor Co. this week is holding a convention of managers from all over America and the foreign countries following a meeting here last week of the foreign representatives and distributors. W. C. Anderson of Bordeaux, who controls Ford distributions in England, France, Denmark and Spain; H. A. Bate, L. C. Griffin, A. Lee, J. J. Harrington, A. H. L. Davies, E. H. Hampton and E. A. Evans are the foreign representatives attending the convention. Harrington is stationed at Copenhagen, Davies at Cadiz, Hampton at Buenos Aires and Evans in Brazil.

Speaking of the outlook from a merchandising standpoint, Anderson declared the capacity of the factory would continue to be taxed for years to come in meeting the foreign demand, if it were possible to devote the entire output to that field. European countries are rapidly recovering from the war experiences and, aside from the great demand for passenger cars, there is a demand for lighter trucks.

Anderson does not take such a pessimistic view of the attitude of foreign countries toward American vehicles as some others. He declared it is impossible to hope for quantity production overseas and expressed the opinion that the public demand for American cars and trucks would force officials to lift the ban which in many instances has been placed on American vehicles through high import duties.

The same expression was heard throughout the convention, all of the foreign representatives declaring their markets had hardly been touched, and insisting that the only question now was one of production in an amount sufficient to meet the foreign demand.

German Cars Lead British April Imports

LONDON, May 28 (Special Correspondence)—According to the American Chamber of Commerce in London, the Board of Trade returns reveal that during the month of April 718 commercial motor vehicles were imported from Germany into Great Britain. The low value of the mark is said to be responsible for the large imports, and reliable German cars have been obtainable in Great Britain at a tempting figure for some time past. This desirable state of affairs is not likely to continue, says the American chamber, since German manufacturers have now decided that from the middle of May they will charge for all exports in the currency of the country to which they are sent. This step, logical though it may seem to German manufacturers, is likely to remove the general incentive, namely, cheapness.

Kansas Bank Takes Farm Truck Notes

Will Advance Funds Where Loan
Is Made Under Federal
Reserve Regulations

OKLAHOMA CITY, June 19—Bankable notes issued by farmers and secured by mortgages on motor trucks or tractors will be accepted for re-discount at the Kansas City Federal Reserve Bank, according to a telegram received here by the Butler-Williams-Wakefield Motor Co., from the bank in reply to an inquiry it made on the subject. The bank's telegram said:

"While it is inconsistent with the policy of our executive committee to pass on any particular note until offered, paper given for farmers' trucks, tractors and implements is technically eligible, and when properly prepared, presented and indorsed by a member of the bank, will be discounted if it otherwise complies with provisions of the Federal Reserve Bank and regulations pertaining to agricultural paper."

A banker at Blackwell, Okla., had called a farmer's attention to the fact that notes secured by mortgages on automobiles were not accepted for re-discount by the Kansas City bank and expressed the opinion that the inhibition extended to notes secured by trucks. When the Butler-Williams-Wakefield Co. heard of this incident it sent its telegram.

(This explanation of the position of the Kansas City bank is expected to clear up a situation which has caused some concern among bankers and dealers. Banks other than the one in Oklahoma evidently were laboring under the same misapprehension for reports from Kansas City have been that banks were refusing to accept paper covering not only trucks but tractors which have been accepted as an absolute essential for increased farm production.)

COMET GETS FOREIGN ORDERS

DECATUR, ILL., June 21—The Comet Automobile Co., has inaugurated a foreign shipping program which will total about 100 cars a month. A first shipment valued at \$90,000 has been sent forward to Belgium, from which point they will be distributed to European points. Payment on the foreign orders is reported to have been made in advance. While most of the cars are being made to conform to European requirements as to driving, etc., the company is doing some missionary work which is intended to popularize the car built to standard American specifications.

START SOUTH BEND PLANTS

SOUTH BEND, IND., June 21—Ground has been broken and construction work started on the new building of the Super-Tread Tire Co. The first unit is to be ready for occupancy Aug. 1, and will be 120 by 140 ft. The second unit will be added this fall and will be devoted to the manufacture of equipment and material for patrons of the Smith one-

heat retreading system molds. Another unit will be added to the Super-Tread Tire Company plant later. These two concerns will be separate corporations, but owned and operated by the same officers and board of directors. The Smith One-Heat Retread System Co. will manufacture tire molds and sell to individuals who wish to put in factories for retreading old tires or for building new tires. It will also manufacture the rubber and cement materials from which their patrons manufacture or retread their tires.

Sandusky Changes Steeds

FREEMONT, OHIO, June 21—The passing of the horse again is demonstrated in the action of the Sandusky County Horse Owners' Mutual Protective Association, which has been rechartered as the Sandusky County Automobile Mutual Protective Association. The horse association has been in existence many years and is a flourishing institution. The advent of the automobile relegated the horse to the "has been" class and practically every horse owner now is driving an automobile.

New York Air Brake to Build a Tractor

WATERTOWN, N. Y., June 19—The New York Air Brake Co., manufacturer of the Three Point Truck which was exhibited for the first time at the New York truck show, is now at work on a tractor. The first model has just been completed and will be put through a thorough test and then given a public demonstration. If the experimental model proves as successful as the engineers hope, production will be started at once and the tractors will soon be placed on the market.

GRANT BUYS FINDLAY PLANT

FINDLAY, OHIO, June 19—Differential Car Co. of New York has purchased the Grant motor plant in Findlay and will begin operations in the near future, manufacturing utility cars, electric dump cars, motor trucks—and trailer dumping bodies. The firm will employ several hundred men. The factory to be occupied, housed the Grant Motor Car Co. before that concern moved to Cleveland.

AKRON LEADING RUBBER CITY

AKRON, June 21—Ohio leads all States in production of rubber goods. Figures published by the Akron chamber of commerce show that Akron produces 41.4 per cent of all rubber goods manufactured in the United States, and 65 per cent of the tires.

During 1919, the report says, Akron produced rubber goods valued at \$427,796,000, while the country's production, exclusive of Akron, amounted to \$667,204,000.

Petroleum Operators Will Meet Demands

Submit Memorandum to Federal
Trade Commission Outlining
Economy Program

NEW YORK, June 21—The American Petroleum Institute which embraces in its membership most of the leading oil producing and manufacturing companies of the country, has made public a memorandum submitted to the Federal Trade Commission in which it says the oil business has "ever met every public and private demand" and that it will continue to do so through:

"Conservation of petroleum and its products.

"Increased production.

"Increased importations.

"Increased efficiency in the construction of automobile engines; a great change in this respect is probable.

"Increased efficiency in refining, i. e., getting more gasoline and other valuable products out of each barrel of crude.

"To attain these ends, it will be necessary for the petroleum industry to have the cooperation of the public and the Government of the United States, both at home and in foreign lands."

In the preliminary statement filed with the commission, the memorandum points out, the Institute stated that in 1919 in the United States domestic production and consumption were: Production, 377,719,000 bbl. and consumption 375,559,000 bbl., an excess of production of 2,160,000 bbl. Stocks at refineries increased 709,000 bbl. during 1919.

"The changes in prices occurred toward the close of the year, while the figures referred to cover the whole of the year," it is asserted. "A material change in the relationship of the production to consumption of petroleum and its products occurred about Aug. 1, 1919—this change has dominated the situation since and has not spent its force.

"As long as production is less than consumption there is no hope for reduction in prices, and the tendency must continue to be upward."

KAMAN RADIATOR BUILDS

AKRON, N. Y., June 19—Work is rapidly progressing on Akron's newest industrial enterprise, that of the Kaman Automobile Radiator company. The building on Jackson street has been completed and work of installing the necessary machinery is under way.

Dr. F. A. Helwig has been elected president and John Taylor, general manager of the company. Mr. Kaman of Rochester, the owner of the patent, has been chosen as plant superintendent.

The radiator has been manufactured on a small scale in Rochester for some time and has, it is said, proven its efficiency. Some of the machinery from the Rochester plant has been installed here and new machines and additional power equipment purchased.

Following the completion and opening of the new plant here, the Rochester plant will be used only for repair work.

S. A. E. Studies Industry's Future

Engineers Open Ottawa Beach Meet

Technical Matters Give Place to
Sports at Opening Sessions—
Attendance Large

OTTAWA BEACH, June 23—Sports have perhaps a shade on fuel in the interest of the Society of Automotive Engineers' semi-annual meeting in session here. The sport program is under direction of H. H. Knepper.

The big interest in sports will continue until Thursday night when \$3,000 in prizes and money will be distributed to the winners during the annual summer dance. The engineers and their friends are proving that they are good sportsmen by some of the scores made in the various games. Tennis appears to have the shade on golf for numbers. The baseball games, played on the lawn with a soft ball, have proved a big attraction.

The Metropolitan section ball team lost the game Monday afternoon to the Midwest section team by the score of 17 to 5. To-day's game was between Detroit and Midwest, score 19 to 6 in favor of Midwest.

The weather has favored the sunshine sports as it has been a trifle cool in the shade and there was a cry for more blankets last night. But the sunshine is most welcome as the crowd arrived Monday morning in the rain and the prospect looked very bad indeed. Nearly all trains were late in getting here and the Monday program did not begin until more than an hour late and then with only enough members present to organize the committee work. By noon there were not many of the regulars absent. That night the registration ran nearly 700 and the full attendance of 900 was very near this evening.

The exhibits have attracted considerable attention. They were not in any sense commercial, but designed to especially interest the engineers. The army ordnance department brought here a tractor power cart, caterpillar hand cart, self-propelled caterpillar mount, Mark V 11 for 75 mm. gun and a wheeled caterpillar Christie for 155 mm. gun, together with guns, limbers, etc. This was a demonstration of after-war improvements.

In the tractor demonstration where actual plowing was done there were eight-sixteen and ten-twenty tractors and a five-ton caterpillar with necessary plows. This demonstration was especially to demonstrate plowing speeds in a movement toward tractor and implement standardization.

Just across the bay there was an experimental engine running on heavy fuel,

using separate intake and exhaust manifolds. This was to prove the running ability of the engine without recommended inlet heating arrangements. The S. A. E. has on exhibition a cutaway truck and a tractor engine to visibly demonstrate the parts standardized.

As an evidence that there is no politics in the present meeting, it might be stated that the election of the nominating committee was quite an exciting event, but merely because of an effort to be certain that the men elected were present and could organize the committee at once. When three such men were found the election was made unanimous. The members are: George K. Dorris of St. Louis, Vincent Apple of Dayton, Carl F. Scott of New York.

The society has been invited to hold the next semi-annual meeting in Buffalo, and several members have started a movement for a meeting in California. The place is not selected during this meeting. Frederick Palmer, the war correspondent, gave two talks to-day on recent observations in Europe.

Fuel Is Considered at Special Session

OTTAWA BEACH, MICH., June 23—A special session of the S. A. E. this afternoon was devoted to the fuel question. It was called when Dr. W. S. James of the Bureau of Standards arrived. He was on the program for Tuesday, but was unable to reach here. He showed moving pictures of manifold experiments and his explanation and the discussion lasted for three hours, intense interest being shown. The pictures were illuminating, showing the parts where most of the unvaporized fuel collects and which, therefore, should be heat jacketed. These parts could be clearly seen as the manifold was made of pyrex glass.

The discussion centered around different forms of manifold, different engine cycles and their effect on fuel economy at full and part load.

McAdoo Favors Trucks for Quick Transportation

NEW YORK, June 22—Here is what William G. McAdoo, former Director General of Railroads, thinks of the transportation problem:

"The country has outgrown its railroad facilities and it will be a long time before the railroads can be brought up to the needs of the country. The most practicable as well as the most immediate relief that can be provided is through good roads and the motor truck."

Transportation Need Aired at Convention

Science of Truck Operation to Be
Worked Out by S. A. E.
Committee

OTTAWA BEACH, MICH., June 23—There appeared to be a danger this morning that the transportation session of the Society of Automotive Engineers' semi-annual meeting would become a discussion of existing road faults rather than of future roads and means of transport, but adjournment stopped what seemed about to become an endless discussion. The subject of transportation was rather new to an S. A. E. meeting and probably the best indication of the work planned was presented by F. W. Davis of the Pierce-Arrow Co., who outlined in his report the work contemplated by the recently established "Committee on the Science of Truck Operation." This committee hopes eventually to work out the question under these five tions.

Comparison of modes of transport; selection of equipment; service stations; principles of operation; cost of operation.

Davis spoke of the work recently accomplished in the educational conferences concerning school plans for educating men for motor transport work. The great need in this connection, he said, was material for instructors.

First on the program of the session was C. A. Green of the Fifth Avenue Coach Co., who told of the experiences of his company and of the great benefit this organization has obtained from human relations and mechanical research work.

A letter from Brigadier General C. V. Drake outlining the plans of the motor transport corps to obtain vehicles was read by Coker Clarkson. General Drake said that the M. T. C. was committed to the standardized chassis but for the first five months of a war the extra vehicles required would be obtained from previously selected commercial types. A recent canvass had shown the manufacturers friendly to the standardized type and that after five months sufficient of these for an army could be obtained. He said commercial production was recognized as far as possible in the chassis designed. Accessories would be selected by performance from those on the market but production limitations would be considered here also.

The subject of roads was brought into the discussion by H. G. Shirley, secretary of the Federal Highway Council, who talked strictly in engineering terms. He said the great need to-day was for a competent and thorough research into subsoil conditions. The highway engi-

(Continued on next page)

Duesenbergs First in Uniontown Race

Four Leading Places Swept By
Team Which Averages Over
90 M.P.H.

UNIONTOWN, PA., June 19—Today's 225-mile Universal trophy race was a Duesenberg day, these cars winning the first four places with Tommy Milton placed first at an average of 94.9 miles for the entire distance. A Monroe finished fifth, a Frontenac sixth and Monroes seventh and eighth.

The official results were: Tommy Milton, Duesenberg, first, 2,22,44.36, average 94.9; Jimmy Murphy, Duesenberg, second, 2,23,29.98, average, 94; Eddie O'Donnell, Duesenberg, third, 2,26,24.45, average, 92.8; I. P. Fetterman, Duesenberg, fourth, 2,28,10.62, average, 91; Ralph Mulford, Monroe, fifth, 2,32,54.60, average, 88.9; Benny Hill, Frontenac, sixth, 2,37,25.79, average, 86.9; Joe Thomas, Monroe, seventh, 2,38,03.35, average, 85.2; Roscoe Sarles, eighth.

Three cars went out because of motor trouble. Gaston Chevrolet went out in the 118th lap, De Palma in the 122nd. Roscoe Sarles had engine trouble and was forced into the pits in the 119th lap, but with Louis Chevrolet in charge the engine was again put in shape and Sarles re-entered the race.

Sarles, Gaston Chevrolet and De Palma were sharp contenders with the Duesenberg team until engine trouble developed, having forced the "Duesies" to high speeds, at times the pilots averaging upward of 101 miles an hour. De Palma lost four laps almost at the start with a broken spark plug. He was forced to the pits twice for tire change but drove his Ballot at terrific speed in a daring effort to gain the lead when a broken valve put him out of the race. Unofficially it is reported he hit a speed of 106 miles an hour at times.

The Meteor car was put out by a wreck on Death Turn in the 180th lap. Wade Morton, the driver, was slightly injured and Arthur Kaempf, mechanic, was seriously injured, being removed to the hospital. He will recover. The attendance was the largest in the history of the speedway. Exclusive of equipment prizes, the Duesenbergs pulled down \$11,500 in prizes and Milton won the second leg of the Universal trophy cup. The Monroes and Frontenacs captured what remained of the \$14,000 in prize money.

Transportation Need Aired at Convention

(Continued from preceding page)

neers had mastered surface but not the foundation. The automotive vehicles had changed conditions as to use of roads so that surface alone would not do. He asked that the S. A. E. members keep always in mind that each vehicle they turned out was adding to the transportation complications.

E. B. Smith, testing engineer of the Federal Bureau of Roads, told briefly of the present work of that bureau in measuring the impact of trucks on highways. He said pneumatic tires greatly lessened this impact but he did not give figures.

Other speakers were V. E. Lacey, representing the New York State Barge Canal, and Carl J. Baer, representing St. Louis Chamber of Commerce, who spoke for inland navigation as represented by the Mississippi River. He asked the engineers to consider the means of propulsion of boats on shallow waters as one of their problems, as steam equipment had proven too heavy.

Gasoline Reserves Show Gain on Demand

NEW YORK, June 19—Figures gathered by the statistical department of the National Automobile Chamber of Commerce indicate that the gasoline situation is steadily improving notwithstanding more or less alarming announcements and the rationing system now in effect on the Pacific Coast. Reserve stocks actually have been on the increase for the past three months. Although consumption has increased very rapidly so has production, with the result that reserves are greater than earlier in the year or at the end of last year.

The supply of crude oil on hand is not as large as in March, 1915, which would indicate that the reserve crude has been cut into somewhat even though the reserve of refined gasoline is greater than ever before. If the basis of comparison is confined simply to the current year it is found that March showed a gain in crude held at refineries, but there is still a shortage at the fields, which is being remedied, however. Production of crude jumped from 33,980,000 gal. in January to 36,491,000 gal. in March.

Experts Seek Check on Gas Evaporation

WASHINGTON, June 21.—Three per cent of the total gasoline production of the country is wasted. The Bureau of Mines' investigation report made public to-day shows that the aggregate loss per year from evaporation is estimated at 122,100,000 gal. in the Mid-Continent field alone. At 22 cents per gallon, the loss in terms of dollars is reckoned at \$26,880,000. It is claimed that the portion of the gasoline loss is the most valuable because it is much lighter.

The investigators claimed that any portion of the gasoline, if saved, would command the highest value. Evaporation of crude oil during storage shows a high rate. Data obtained in many investigations by Federal agents brought the conclusion that the major portion of the loss is on the lease when the oil is still fresh. Relief from the gasoline shortage would be accorded in a small measure, the experts believe, by protecting the oil from free contact with air.

Aeromarine Launches 14-Passenger Craft Eight-ton Commercial Model Shows Paces in Trial Flight

NEW YORK, June 22—"Aeromarine," a new 14-passenger flying boat, was launched successfully yesterday afternoon at the plant of the Aeromarine Plane & Motor Co., Keyport, N. J. It was christened by Governor Edward I. Edwards in the presence of several naval officers and other invited guests. It is whispered a bottle of real champagne was used in the christening ceremony. The governor was among the passengers on the first flight of the big boat. He was enthusiastic over the experience and is convinced important developments are certain in commercial aviation.

The "Aeromarine" is the largest civilian passenger flying boat in the United States. It follows conventional engineering lines and is novel only because of its size. In some respects it is similar to the air cruisers of the navy. The wing spread is 103 feet and the hull is 50 feet in length. The weight is 8 tons. It has two luxuriously equipped cabins accommodating nine, a smoking compartment for five and a buffet. The interior is electrically lighted and mahogany finished. There is a large luggage space, ventilators and automatic window shades.

The "Aeromarine" is powered with two 400-hp. Liberty engines, giving it an average speed of 90 nautical miles and a maximum of 105 miles. It has a cruising radius of five hours. The majority of the passengers are seated in the forward part of the hull and the others in the rear cabin.

More than 6000 separate pieces of wood were used in the construction. More than 50,000 screws were used. 46,000 nails, 4600 sq. ft. of fabric, 1000 ft. of steel tubing divided into 250 pieces, 5000 ft. of wire and cable, 500 turnbuckles, 1500 each of pulleys, nuts, washers and metal fittings.

CHARLES BLIZZARD DIES

PHILADELPHIA, June 19—The electrical industry has lost one of its pioneers by the death of Charles Blizzard, third vice-president of the Electric Storage Battery Co., at his home in this city. He was 56 years old.

Mr. Blizzard became associated with the Electric Storage Battery Co. in 1893 as manager of the New York branch and seven years later was placed in charge of sales in the home office. For 27 years he filled with distinction all the important positions he held. His election to a vice-presidency came in 1906. He was an active figure in the old Electric Vehicle Association and at the time of his death was a member of the board of governors and chairman of the finance committee of the Associated Manufacturers of Electrical Supplies. He also represented his company in the Motor and Accessory Manufacturers' Association.

Attempt to Form Astra Motors Fails

Company Which Was to Take Over Dorris Motors Turns Back Stock

ST. LOUIS, June 22—B. R. Parrott, former president of the Dorris Motors Corp. of New Jersey, apparently has failed in his effort to establish a company to take over the Dorris Motor Car Co. under the name of the Astra Motors Corp. He has been in Kentucky, but it is said he will return to St. Louis to defend his position in vacating the presidency of the company after it had sold approximately \$349,000 in stock but did not carry out its contract with the Dorris Motor Car Co.

Friends of Parrott assert he spent \$40,000 of his own money on the deal and that he did not profit by the sale of stock. Two months ago it was announced that Marion C. Early had succeeded Parrott in the presidency, but Early has denied that such was the case.

"I have no connection with the corporation," he said. "My sole interest is that of being the representative of a group of men who have considered underwriting stock in the corporation. I am vitally interested in seeing that justice is done in the matter."

An examination of the books of the Dorris Motor Corp. shows that Parrott stood to clear a handsome profit had the stock of the company been successfully floated and the contract with the Dorris Motor Car Co. for the purchase of 6400 shares of its common stock been completed. He made a contract with the stockholders of the Dorris Motor Car Co. to buy this stock at \$50 a share and he was to have turned the stock over to the Dorris Motors Corp. for \$453,000.

Shortly before he resigned, Parrott turned back \$360,000 of this stock and later the remainder by signing contracts in blank with the Dorris Motors Corp. Parrott is understood to have been backed to the extent of \$50,000 by a Davenport, Iowa, banker.

Meanwhile the Dorris Motor Car Co., headed by G. P. Dorris, is proceeding calmly with the production of cars. Its output for a long time was in the neighborhood of 50 a week but this has been increased to 80, and it is Dorris' purpose to increase it to 100 a week.

Purchasers of stock in the Dorris Motors Corp. are understood to be anxious to exchange it for stock in the genuine company, and reports are that Dorris is not opposed to this proposal. He is said to be willing to go to almost any length to uphold the reputation of his company for honor and integrity.

BILL OF LADING MEETING

WASHINGTON, June 19—Automotive shippers engaged in foreign trade will be asked to participate in the conference which the Interstate Commerce Commission will conduct in the matter of export bills of lading. Notice was served on all

carriers to-day to submit, on or before Aug. 1, 1920, tentative forms of through export bills of lading which they may desire to issue in connection with carriers by water whose vessels are registered under the laws of the United States, and in connection with carriers whose vessels are of foreign registry.

It is intended to give automotive exporters an opportunity to file objections or suggestions for revisions they may want with respect to the form and substance of the proposed export bill of lading. The commission is of the opinion that differences existing between shippers and carriers will end shortly.

El Automovil Americano to Be Issued Monthly

NEW YORK, June 22—With its October issue, *El Automovil Americano*, the automotive export publication in Spanish of the Class Journal Co., will become a monthly. This change from its issuance each quarter has been necessitated by the greatly increased use of American automotive equipment in Central and South America, Spain, Portugal and other Spanish and Portuguese speaking territories in which the magazine circulates.

El Automovil Americano was established four years ago as a publication devoted to the American automotive industry and serving as a medium of exchange between it and the automotive trade in the various countries of its circulation. It devotes itself to passenger cars, trucks, tractors, motorcycles, airplanes, motorboats, farm lighting plants and automotive accessories and equipment.

It is published by the Class Journal Co., which also publishes *Automotive Industries*, *Motor World*, *Motor Age*, *The Commercial Vehicle*, *Motor Boat*, *Distribution & Warehousing*, and the "Tire Rate Book."

ETHICS CODES FOR N. A. D. A.

ST. LOUIS, June 19—Pursuant to resolutions of the Chicago convention of January, 1920, President H. B. Harper of the National Automobile Dealers Association, has appointed a committee to draft codes of ethics for dealers and service men which are to be known as the National Automobile Dealers Association Code of Dealer Ethics, and the National Automobile Dealers Association Code of Service Ethics.

HAYNES FIRST IN AMERICA

NEW YORK, June 21—The Haynes car as built by the Apperson Bros., in the old Riverside Machine Works, Kokomo, was the first automobile in America. At the time the Haynes car was first successfully operated here, July 4, 1894, the Benz cars were operating in Europe.

Darracq-Talbot and Sunbeam Merge

Prominent Anglo-French Company and British Maker Combine to Strengthen Business

LONDON, June 9 (*Special Correspondence*)—A rumor for some time current in British motor trade circles is confirmed by the announcement that the Darracq-Talbot car interests have been combined with the Sunbeam companies of Wolverhampton. The Darracq-Talbot fusion came about last autumn, and though the Darracq factory is in France, the capital is British. The Talbot company was originally Anglo-French and was known as the Clement-Talbot, the firm's name denoting the parent products of the French Clement company, while Talbot is the family name of the English peer—the Earl of Shrewsbury and Talbot—who was chief director and pioneer of the British company.

The Talbot works cover about 20 acres in the North Kensington area of London, and used to be accounted very up-to-date in plant and methods. The Sunbeam company is one of the oldest British motor car companies, and has stuck steadily to the car side of the industry. In more recent years it has become, and continues to be a very live company, reflecting the personality of Louis Coatalen, its technical chief.

Aircraft engines absorbed its chief attentions during the war. It is not too clear what improving effect is looked for from this fusion excepting as regards purchase of materials, and preventing overlapping competition with the same type and category of car. Before the war, Talbot and Sunbeam cars were strong competitors, and more recently—since the advent of Mr. Clegg to the Darracq company on his leaving the Rover company of Coventry, that make began "to cut in."

The Darracq-Talbot interests some time ago acquired the business of Whitehead of Leeds, the leading leaf spring manufacturer for automobiles in England, and also own the Heenan & Fronde business at Worcester and Manchester, an important product of which is the well-known water absorption dynamometer largely used for testing engines.

The Sunbeam company's capital is \$35,000,000. It paid a dividend rate in 1918-1919 of 10 per cent as against 20 per cent the previous year, before the capital had been increased. The Darracq company, before absorbing the Talbot, paid a dividend of 20 per cent.

GOODYEAR COAST PLANT STARTS

AKRON, June 18—Officials of Goodyear Tire and Rubber Co. received a message Tuesday announcing the starting of the new \$20,000,000 plant at Los Angeles, the first finished tire leaving the factory ten months and two days after ground was broken. Fifty 30 x 3 clincher pneumatic tires were completed the first day. A production of 500 tires daily is expected to be reached in thirty days.

Transportation Cuts Mitchell Production

Many Employees Laid Off Until
Railroad Situation Clears—
Finances Satisfactory

NEW YORK, June 23—Bankers interested in the Mitchell Motors Co., Inc., returned yesterday from a meeting of the directors held at Racine. They report that the company is in an entirely satisfactory position financially and that it has had a profitable year. There is a good demand for Mitchell cars and if it were not for transportation difficulties production could not keep pace with orders.

Like all other companies, however, the Mitchell is having difficulty in getting materials to its plant and in shipping its product. This has resulted in an unbalanced inventory and an accumulation of cars which it has not been possible to get to their destinations over the railroads. As a consequence production has been curtailed and a good many of the factory workers have been laid off. The company proposes to proceed carefully while conditions are as unsettled as they are now. When the transportation situation approaches normal it will go ahead again, full speed.

Emphatic denial is made of reports current in the industry, especially in Chicago and Detroit, that the company is in financial difficulties. Its last report is said to have been satisfactory and it is maintaining substantial bank balances.

Ford Ready to Start Troy Tractor Plant

TROY, N. Y., June 21—Following the signature of the Water Power bill by President Wilson word has been received here that Henry Ford will begin the construction of the projected tractor plant at Green Island as soon as the license to use the power from the dam can be obtained. It is understood that work on the plant will be under way before the end of the year. Plans for the plant were originally announced last November and are expected to be followed with little change.

The property on which the plant will be erected comprises more than 150 acres, part of which it is planned to develop as a residential section for the employees. The project will include large docks on the Hudson, but the first work, it is reported, will be confined to the construction of three manufacturing units and an administration building.

Italian Engine Has Two Pistons in Cylinder

WASHINGTON, June 23—Consul General Wilber has forwarded to the Department of Commerce a description of a new engine recently invented by an Italian engineer named Severe Campofregoso. It is understood that the engine is patented here and abroad.

The description does not shed any real light on the design of the engine nor on the principle on which it operates. It is not, however, of the four-cycle type, but has two pistons in one cylinder, these being opposed to one another and being driven apart by the force of the explosion. It is stated that there are no valves and that the charge is delivered to the combustion chamber under a controlled pressure and not taken in by displacement as in the ordinary four-cycle type. The mixture seems to be compressed in the lower crankcase and delivered from there to the combustion chamber through ports around the edge of the cylinder, and in this respect it would seem to closely resemble the two-cycle principle.

Truck Crosses Country in Thirteen Day Trip

NEW YORK, June 22—What is believed to be a record for a coast-to-coast trip was established at 11.15 p. m. Sunday when a 3-ton Packard truck, equipped with Goodyear pneumatic tires, arrived in New York from Los Angeles. The distance of 3451 miles was covered in 13 days, 13 hours and 15 minutes. The trip demonstrates the possibilities of pneumatically-equipped trucks. The entire journey was made with one set of tires. The former record, made in 1918, was 17 days and 3 hours.

The record was made by a truck not especially constructed for the test. The truck used already had rolled up a mileage of 120,000, including two round trips across the continent. Even with the record-breaking time, smooth running was not encountered all the way. Nearly four hours were lost at Seligman, Ariz., getting under the Santa Fe tracks and high water in the Rio Grande outside Albuquerque, with the breaking of a bridge, made necessary detours which took 32 hours to cover 34 miles. Many of the roads in New Mexico were almost impassable.

The truck was equipped with 44 x 10 tires on the rear and 38 x 7 on the front wheels. An extra set was carried but was not needed. The truck has been in operation since April, 1918. It was first used between Akron and Boston, hauling freight. It made its first trip to the west coast from Boston in September, 1918, with a load of airplane tires. On the way back it carried a load of cotton to Boston from Arizona. It has been used to make demonstrations in 32 States in commercial and farm hauling.

SAYERS ON NON-UNION BASIS

CINCINNATI, June 19—The Sayers & Scovill Company, manufacturers of the Sayers Six, are again operating their factories with full force. About 100 employees in the body building and trimming departments, who have been out on a "vacation" for about three weeks, have returned to work.

The differences have been satisfactorily settled between the employers and employees and the employees returned to work with the understanding that the factory will be a non-union shop.

Zeppelin Aircraft May Be Built Here

Company Seeks Sale of Patent
Rights—Ford and Goodyear
Interested

NEW YORK, June 22—Representatives of the Zeppelin interests in Germany, who are now in the United States, already have visited Akron and Detroit. They are trying to interest financial support in the acquisition of the Zeppelin patent rights for production of the giant airships in this country. They assert they are forced to seek capital because Germany has been impoverished by the war and because the restrictions placed on the development of aircraft under the peace treaty have tended to check interest in aeronautics in their country.

At Akron they gave an illustrated lecture at the Goodyear plant which was attended by F. A. Seiberling, president of the company, and the Goodyear aviation experts who have developed the dirigibles the company is making. Seiberling and his assistants were deeply interested in their description of an airship with a lifting capacity of 80 tons. The Germans offered to build one of the ships at cost to prove its practicability.

From Akron the Germans went to Detroit where they have conferred with Henry Ford and his aviation advisers. It is well understood that Ford has plans virtually developed for the building of dirigibles and other aircraft.

No information is available as to what success has attended the efforts of the Zeppelin agents to interest Americans in the purchase of their patent rights.

N. A. C. C. ENLARGES STAFF

NEW YORK, June 23—To further facilitate the handling of traffic matters affecting the automobile industry, Kenneth A. Moore, formerly general agent of the New York Central lines, has been added to the staff of the National Automobile Chamber of Commerce as assistant traffic manager in the western district with headquarters at 1009 Ford Building, Detroit.

The N. A. C. C. also has enlarged its staff in the motor truck department by adding Captain L. E. Gossett, a graduate of the Motor Transport Corps of the United States Army, to assist in the Rural Motor Express Division.

BIDDLE MOTOR OFFERS STOCK

NEW YORK, June 19—The Biddle Motor Car Co. has sent to stockholders of the Maibohm Motors Co. a circular letter announcing that at the request of H. C. Maibohm they are given an opportunity of subscribing to some of the Biddle stock. Maibohm is credited with being the controlling factor in the reorganized Biddle company. The circular letter says Maibohm believes the Maibohm company will earn 75 per cent of its entire capital this year and that Biddle will be equally successful.

INDUSTRIAL NOTES

Automatic Parts Co., Indianapolis, has started operations in its new plant, Massachusetts Avenue and Fan Street. Moving operations were completed in 45 days without disturbing production. The present unit covers 20,000 square feet and there is room for expansion. Present production is 850 radiator-cooling fans daily.

Chance Marine Construction Co., Annapolis, Md., has bought the plant, patterns, product in course of manufacture, etc., of the Page Engineering Co., Baltimore, manufacturers of Oriole marine engines, and has moved the equipment into a new building at the Annapolis plant.

Chevrolet Motor Co. will establish a complete machine shop, 100 x 150 feet, to handle all features of parts manufacture and repair work in connection with the new service building to be erected in Newark, N. J. The estimated cost of the entire plant is \$250,000.

Fairbanks-Morse & Co., at the Chicago plant, report the pensioning of eight employees and the payment of death benefits aggregating \$11,625. Net resources of the pension fund are reported as \$505,000 invested in high-grade bonds.

Triangle Truck Co. production will be tripled in the near future with the completion of the new factory building in which equipment and machinery rapidly is being installed.

Cyclone Starter & Truck Co. is erecting a factory at Greenville, S. C., for the manufacture of cyclone starters and 1-ton trucks. Production will start about Sept. 1.

Southland Steamship Co., Savannah, has acquired the manufacturing rights of all patents owned by S. L. Leiby, Charlestown, S. C., on searchlights, lighting outfits, etc.

Lake Motor Co., Appleton, Wis., is being fitted up with additional equipment to permit of a production of 50 engines daily in 1921.

Pillar Products Co., Milwaukee, will construct a modern plant in the near future which will permit quadrupling present production.

Oberdorfer Brass Co., Syracuse, is building a new plant at Eastport, N. Y., which will be ready for occupancy by October.

Day & Night Automobile Signal Co. has been organized in Portland, Ore., to manufacture a signal for automobiles.

American Metal Products Co., Milwaukee, is soon to erect a new machine shop and foundry to permit of enlarging production.

Service Casting Co., Blanchester, Ohio, has been organized to make small grey iron castings for the trade.

The Cadillac Iron Plant expects to be producing within ninety days with a force of twenty men.

Dittmer Gear & Mfg. Co., Lockport, N. Y., reports orders totaling \$360,000 on its books.

HURLBURT RECEIVER NAMED

NEW YORK, June 22—A petition in bankruptcy has been filed against the Hurlburt Motors, Inc., the selling agency for the Hurlburt Motor Truck Co. Joseph C. Benson has been appointed receiver. The liabilities are placed at \$75,000 and the assets at \$15,000. William B. Hurlburt, organizer of the Hurlburt Motor Truck Co., is president of the selling company. He attributes the rupture between the manufacturing and selling organizations to his unwillingness to take

care of creditors through a new issue of second preferred stock rather than on a cash basis. Hurlburt trucks are now being manufactured by the Harrisburg Mfg. & Boiler Co. and uncertain deliveries added to the troubles of the selling company.

Studebaker Celebrates
Opening of New Plant

SOUTH BEND, IND., June 21—Next Saturday will be a holiday for 7000 Studebaker employees here, the occasion being the official opening of the new \$20,000,000 plant of the corporation in this city in which the Studebaker light-six will be produced complete. The opening will be celebrated at the plants, on the streets of the city and at an amusement park. The festivities will begin with a parade of Studebaker officials and employees, headed by the 100-piece Studebaker band. At the park the employees and their families will participate in field day stunts and events, a circus and a barbecue. In the evening the corporation will give a banquet in the dining room of the new plant, which will be attended by men prominent in automotive and financial circles and representatives of the automotive press.

Left-hand Drive Cars
Opposed in England

LONDON, June 8 (*Special Correspondence*)—A very definite agitation has arisen here against left hand steering gear. There have been numerous accidents in London of late with vehicles of this type and it is not improbable police action will be taken to restrict the introduction of any further left-drive cars after a certain date. It is likely time will be given to convert all existing left-drive vehicles.

The *Daily Mail* has taken the lead in the agitation. It is contended that a driver seated on the left of a car cannot signal the traffic behind him as surely as he could if he were driving on the right of the machine.

TO DEVELOP DOYLESTOWN PLANT

NEW YORK, June 22—Important developments at the Doylestown Agricultural Works, Doylestown, Pa., which it recently purchased, are planned by the General Motors Corp. in line with its policy of greatly increasing production of motor trucks and farm machinery. It is understood the corporation will expend \$1,000,000 on plant expansion within the next two years.

FORM DISK WHEEL COMPANY

GRAND RAPIDS, MICH., June 22—The Roadway Transmission Co., with a capital of \$1,000,000 or more, is being organized here to manufacture high grade steel disk wheels for automobiles. Plans are being drawn for the erection of one-story brick factory building to cost \$160,000. Gustav A. Hendericks, president of the Adjustable Table Co., is promoting the new enterprise.

METAL MARKETS

In spite of the seasonable curb put on buying in the automotive industries by reason the last week in June being generally devoted to stocktaking for inventory purposes, steel makers continue to report good sized inquiries from that quarter, especially for automobile sheets, sheet bars from which to roll the former and for bolts and nuts. Purchasing agents, however, are inclined to defer the placing of fresh business until after the wage agreement between the independent steel mills and the Amalgamated Association of Iron, Steel and Tin Workers which is due for consummation early in July is out of the way and its tenor known. While some automobile plants are preparing to place orders for third quarter deliveries, others have placed an aggregate of several thousand tons of sheets on the resale market. This anomalous situation is made still more unusual by continuance of heavy premiums on such iron and steel as automotive builders need immediately. Buying of the latter sort, however, has decidedly slumped off.

Steel—Several thousand tons of 3-pass, pickled and annealed black sheets for third quarter delivery are being offered by New York brokers, acting for automotive interests. The prices asked range from 8.50 to 9.00c. base, Pittsburgh. Sheet bars for conversion into automobile sheets are generally held at \$75, but sales at \$80 and \$85 are made occasionally when a buyer is known to be hard up for quick delivery. The consensus of opinion among steel men is that the crest of the market has been reached which is a diplomatic way of stating that automotive buyers have ceased their somewhat ill requited policy of liberality and that more and more of them appear to bear in mind that the Steel Corporation's price for sheet bars is \$42. From Cleveland comes word that one bolt mill has sold to an automobile manufacturer 800,000 rim bolts. Several Pittsburgh bolt and nut makers have advanced their price approximately 15 per cent. Most of these manufacturers claim to be sold up over the remainder of the year.

Pig Iron—The undertone of the foundry iron market which continues nominally on a \$45 base, reflects the hesitancy of buyers to commit themselves at prices brought about rather through competition among themselves than through an advance in producing costs corresponding to the 6 1/2 per cent rise in price which the market shows over the end of June a year ago. Pig iron is now being sold as a by-product of the automotive industry, 1.75 to 2.25 per cent silicon metal from the first blast of the Ford furnace at River Rouge, Mich., being offered at \$44, furnace.

Aluminum—The sole American producer is striving valiantly to overcome transportation difficulties which make not only difficult the shipment of refined metal, but also the flow of bauxite to the smelteries. The market is steady and there is very little reselling of virgin metal. The American Society for Testing Material is considering tentatively a change in standards, three grades, one with 99.5 per cent minimum purity for aeronautical construction, one of 99 per cent and one of 98 per cent minimum purity to replace the prevailing 98 to 99 per cent range for virgin metal.

Lead—The leading interest has reduced its official quotation to 7.75c. East St. Louis, to forestall foreign competition. It is difficult, however, to obtain metal at that level. Resellers have withdrawn from the market for the time being.

Antimony—Japanese metal is offered at around 7 1/2c. For the first time since the war some consumers are again taking to the use of English antimony at relatively high prices.

Automotive Financial Notes

Hupp Motor Car Corp., which includes the American Gear & Mfg. Co., reports net profits for the quarter ended March 31 as \$1,155,580 before Federal taxes. The consolidated balance sheet as of March 31 shows cash amounting to \$1,049,863; accounts receivable \$1,077,749; bills receivable, \$20,000; inventories at cost, \$3,038,013; current accounts payable not due, \$1,971,954; reserve for Federal and other taxes, \$728,378, and total assets and liabilities of \$13,747,326.

Liberty Motor Car Co. has declared the regular quarterly dividend of 2½ per cent on the common stock and 2 per cent on the preferred, also a participating dividend of 2 per cent on the preferred stock, all payable July 1. The participating dividend represents an extra distribution which is made to preferred stockholders in each year that the common stockholders receive a total of 10 per cent in dividends.

Maibohm Motors Co. has declared a regular 2 per cent quarterly dividend, payable July 1 to stock of record June 15. April sales were reported 39 per cent in excess of March and May shipments 13 3/5 per cent in excess of April. Earnings in the first five months of 1920 approximate 20 per cent, or at the rate of 50 per cent per annum.

H. H. Franklin Mfg. Co. stockholders have ratified the company's plan to issue no par value common stock. Present common stockholders will receive four shares of no par value for each share of the present stock. A quarterly dividend of 75 cents a share on the new common stock was declared.

Trego Automotive Corp., Boston and New Haven.—Incorporated with a capital of \$500,000 in preferred stock and 5,000 shares of common of no par value to build motors for vehicles. Incorporators, Leah M. Wessenger, of Malden, Mass., Leon E. Thompson, of Lynn, and Ernest Luce, of Winchester.

Dodge Manufacturing Co. directors have declared a quarterly dividend of 1½ per cent on preferred, payable July 1, to stockholders of June 20. A dividend of 1½ per cent and an extra dividend of 1 per cent on common was declared payable July 1 to stockholders of June 26.

Spicer Mfg. Co. has declared an initial dividend of 50 cents a share on common stock, payable Aug. 1 to stock of record July 20. The company's net earnings for the four months ended April 30 after taxes were at the rate of \$2,000,000 annually.

Falls Motors Corp. has declared all back dividends on the preferred stock covering a period of a year and three-quarters. Earnings on the common stock are reported now to be at a rate of 25 per cent after allowing for all charges.

Electric Storage Battery Co. stockholders will meet July 9 to vote on increasing the company's capital from \$18,000,000 to \$30,000,000. The proceeds of the proposed new issue of stock will be used for the construction of new plants.

Benton Harbor Malleable Foundry Co. has purchased the plant and buildings of the Cray Machine Works at Benton Harbor, Mich. The latter concern has purchased a site 72 x 200 ft. on which to erect a new plant.

General Motors Research Corp.—Incorporated in Delaware with a capital of \$100,000 to acquire and develop patents of all kinds. Incorporators are Henry M. Hogan, Frank A. Gaynor and James McEvoy, all of New York.

Napoleon Motors Co., Traverse City, Mich., has secured the approval of its stockholders to a plan to increase the capital of the company from \$500,000 to \$2,500,000, the new stock to be half preferred and half common.

Curran-Detroit Radiator Co. at a special meeting voted to increase the company's directorate, and W. J. Murray, of the Murray Cartage Co., and E. P. Harms, of the Detroit Vapor Stove Co., were elected to the board.

Globe Rubber Tire Mfg. Co. will pay a stock dividend of 10 per cent on July 1. This is the second 10 per cent stock dividend this year in addition to two regular quarterly cash dividends of 1½ per cent.

Steinmetz Electric Motor Truck Corp. has purchased the property of Reus Bros. at Arlington, Md., upon which a plant will be erected. Manufacture of trucks will begin as soon as possible.

Motor Wheel Corp. last week distributed the stock dividend of 50 per cent common. The company paid 2½ per cent in cash. The new stock is being offered at around \$13 on the Detroit Exchange.

Simplicity Mfg. Co., of Grand Rapids, has incorporated as the Simplicity Products Mfg. Co., with a capitalization of \$200,000. The company manufactures demountable wheels and other specialties.

Texas Motor Car Co. has been granted a charter to do business in Texas with a capital stock of \$100,000. The company will be located at Eastland.

Harloe Tire Co., Winchester, Va., has been incorporated with \$500,000 capital to manufacture tires. It will erect a plant to cost \$150,000.

C. R. Wilson Body Co. directors have declared a quarterly dividend of 1¼ per cent on preferred payable July 1 to stockholders June 19.

Electric Storage Battery Co. has declared a dividend of \$2.50 a share on both preferred and common, payable July 1 to stockholders June 14.

Moon Motor Car Co., St. Louis, has declared a quarterly dividend of 1½ per cent on preferred stock outstanding July 1.

Bethlehem Motors Corp., Allentown, Pa., has arranged an expansion program aggregating about \$1,300,000 for extensions.

Midwest Engine Stock Taken by Majority

INDIANAPOLIS, June 19—Stoughton A. Fletcher, president of the Fletcher American National Bank, and several local associates have acquired the large minority interest in the Midwest Engine Co. Fletcher had, prior to this time, the majority control of the stock. The transfer of this minority interest, which it is reported was between 40 and 49 per cent of the common stock, was accompanied by the acquisition of approximately \$1,000,000 worth of the preferred stock of the company.

It is Fletcher's purpose to finance the enterprise on a large scale in order to take care of the great demand for the small tractor manufactured by the Midwest company. The board of directors of the new company, the Midwest Engine company, incorporated under the laws of Delaware, includes Walter Marmon, president of the Nordyke & Marmon Co.; J. J. Cole, president of the Cole Motor Co.; Lucius Wainwright, president of the Diamond Chain Co.; Charles B. Sommers, president of the Gibson Co.; Carl G. Fisher, James A. Allison and several other capitalists. John Wood will continue as president of the company and the active management will remain the same.

Bank Credits

Written exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co., second largest bank in America.

NEW YORK, June 23—The outbreak again of the outlaw railroad strike in the vicinity of Baltimore, if it spreads at all, will be a further handicap in the present transportation tie-up which is retarding to a great extent the process of liquidation and has necessarily been a factor in the tightening of our credit situation.

The money market for the last week has been unusually quiet, considering the big turnover due to income and excess profits tax payments, and payment of \$28,000,000 Treasury Certificates of Indebtedness, payment of \$125,000,000 interest on Liberty Bonds and Victory Notes, and payment by banks of subscriptions to the new \$400,000,000 Treasury Certificate issue. Bank clearings for the week ended June 19 were \$9,215,000,000, compared with \$8,221,000,000 for the previous week, which is an indication of the large turnover.

Call money has been easier at this center practically all week. There was a rise to 9 per cent on Friday and 11 per cent on Monday, but the predominant rate was 7 per cent. Time money continued extremely scarce and rates ranged from 8 to 8½ per cent.

The Federal Reserve system made considerable improvement in its technical position. The total gold holdings decreased \$2,737,000, but its holdings of bills decreased \$232,118,000, the chief decrease being in bills secured by Government paper of \$209,090,000. There resulted a decrease in members' reserve account of \$70,273,000 and Federal Reserve Notes outstanding \$7,395,000, as compared with the previous week. The ratio of gold reserve to Federal Reserve Notes in circulation, after setting aside the minimum reserve of 35 per cent against net deposits, amounted to 49.4 per cent, compared with 47.5 per cent the previous week, while Government deposits increased \$34,526,000. Total bills discounted for other Federal Reserve banks of Boston, New York and Cleveland Banks amounted to \$96,060,000 as compared with \$127,000,000 for the previous week.

Men of the Industry

Herman A. Finke, formerly manager of the service section, equipment department, of the Fairbanks Co. at St. Louis, has been placed in charge of the design and production of the Saunders rotary internal combustion engine. This engine is being redesigned to meet the requirements of railroad service. Finke will be chief engineer in charge of motor development and the construction of the factory which it is proposed to build. A company has been incorporated in Illinois with a capital of \$1,500,000.

E. B. Jackson, vice-president of the Willys-Overland Co., in charge of sales, will maintain his headquarters in New York. A. C. Barber has been appointed sales manager for the Detroit territory under Jackson. The financial position of the Willys organization has been greatly strengthened by the admission of new interests which are said to have been attracted to it by Walter P. Chrysler, vice-president and general manager, who formerly was vice-president of the General Motors Corp.

C. V. Sweet and **L. V. Teesdale**, experts in kiln drying at the United States Forest Products Laboratory at Madison, Wis., have resigned to accept positions in foreign countries. Sweet will have his headquarters at Dehra Dun, India, and Teesdale at Rangoon, Burma. They will investigate commercial methods of seasoning timber.

Allan E. Goodhue has been elected vice-president in charge of sales of the Chicago Pneumatic Tool Co. Since May 1, 1919, he has been managing director of the company's English subsidiary, the Consolidated Pneumatic Tool Co., London, also director of European sales of the Chicago company. He will arrive in New York July 3.

C. D. Rockwood, purchasing agent of the Mason Tire & Rubber Co., Kent, Ohio, has returned from the Far East where, in connection with J. P. Mathews, resident manager of the Mason rubber plantations at Singapore, negotiations looking to the extension of the company's holdings were carried out.

B. G. Prytz has resigned the presidency of S K F Industries, Inc., to become managing director of the parent company with headquarters in Gothenburg, Sweden. F. B. Kirkbride, vice-president since the organization of the company, was elected president to succeed Prytz.

L. M. Baker has resigned as supervisor of sales of the motor equipment division of the Hyatt Roller Bearing Co., to become associated with the Dittmer Gear & Manufacturing Co., of Rockport, New York, as representative in Michigan. His headquarters will be in Detroit.

Oscar Coolican, manager of the Packard Detroit branch, has resigned to join Hare's Motors as president and general manager of the Philadelphia branch. George Helm of the Packard sales organization also has resigned to join the forces of Emlen S. Hare.

Alcis Hauser has been appointed assistant to the works manager in charge of engineering of the Timken Roller Bearing Co., Canton, Ohio. For the past several years Hauser has been efficiency engineer at the Saucon plant of the Bethlehem Steel Co.

H. B. Vanpelt and his son Donald have established the Service Steel Co. at Rivard and Maple Streets, in Detroit. The former for the last four years has been vice-president and sales manager of the Pittsburgh Shafting Co., of Detroit.

R. P. Pennock, formerly in the purchasing department of the Leach Biltwell Motor Co., Los Angeles, has been transferred to the sales department as district manager of the southwestern part of the United States.

L. R. German has been elected a vice-president and director of the Olds Motor Works, Lansing. He has been with the company some time and two years ago was elected comptroller.

Garvin Denby who has been elected president of the reorganized Fulton Motor Truck Co., has moved his family to Farmingdale, Long Island, where he will make his headquarters.

A. H. Bosworth, well known in the marine field, has been elected vice-president of the Colador Engineering Corp., and E. E. Adams has resigned from the Koolsave Valve Co. to become sales director.

D. M. Roberts, automobile editor of several Southern newspapers, is to be advertising manager of the new Simms Motor Car Corp., Atlanta, which will make a new \$1,200 four-cylinder car.

E. J. Boggan has resigned as factory manager of the United States Metal Goods Co., Cleveland, to enter the executive organization of the Dittmer Gear & Mfg. Corp., as sales engineer.

C. L. Mason has been made district sales manager for the North central district of the United States for the Firestone Tire and Rubber Co. His headquarters will be in Akron.

E. A. Samuels, who became associated with the Four Wheel Drive Truck Co., at Clintonville, Wisconsin, about a year ago, has been promoted to the post of assistant sales manager.

Charles Frederick Higham, head of the London district for Goodrich tires and American motor cars, was the guest of the Pilgrim Publicity Association at a dinner in Boston.

Conrad Deierlein has been appointed general superintendent of the factory of the Franklin Automobile Co. He joined the organization twelve years ago as a machinist.

L. B. Cravath has been appointed special representative of the J. I. Case Plow Works Co., Racine, Wis. He formerly represented the Advance-Rumely Co. at Calgary, Alberta.

C. G. Low has been made manager of the Alemite sales and service station in Grand Rapids, which will be the distributing center for a large portion of Michigan.

A. G. Maney, formerly with the Wright-Martin Aircraft Corp., has been appointed assistant to H. H. Franklin, president of the Franklin Automobile Co.

R. H. Sherry has resigned as metallurgist of the General Motors Corp., to become metallurgist engineer for the Willys Corp., in Elizabeth, New Jersey.

Henry Caldwell, formerly automobile editor of the New York Tribune and New York Herald, has been appointed publicity representative of Hare's Motors.

E. A. Wilson, for two years credit manager of the Packard Motor Co., Detroit branch, has resigned and will accept a connection in Los Angeles.

Jay Chamberlain has been appointed manager of the Cleveland office and L. J. Waldron of the Boston office of the Pennsylvania Rubber Co.

V. J. Hoffman has been made purchasing agent of the Mearing Service Co., succeeding J. W. Owen who has been placed in charge of sales.

B. Venson has been elected vice-president of the Spicer Mfg. Co. to succeed H. D. Williams, resigned.

Willys Chosen Head of Republic Truck

NEW YORK, June 22—John N. Willys has been elected president of the Republic Motor Truck Co. to succeed F. W. Ruggles, who has retired from the company. Willys, Ruggles and W. J. Baxter acquired a controlling interest in the company last November, so that Willys' connection with it is not new.

No information was available at Willys' office to-day as to what significance, if any, attaches to his election to the presidency. It was intimated, however, that it merely followed the natural course of events. It has been the assumption in the trade that it might presage increased production of Republic trucks, although the company already is one of the largest producers, with an estimated output of 15,000 for 1920.

When Willys, Ruggles and Baxter acquired control of the Republic company it was announced that the Willys-Overland Co. was not concerned in the transaction. Complete control of the administrative policies remained in the hands of Ruggles and it is assumed now by Willys, who has purchased Ruggles' stock.

No statement of his plans has been made by Ruggles. He declined to confirm or deny reports that he is planning another truck company. There is no confirmation of stories of a controversy between the two men.

Bruenauer Elected Chicago Axle Official

CHICAGO, June 18—Otto Bruenauer has been elected vice-president and general manager of the Chicago Standard Axle Co. This brings him back into the parts business after a brief absence. He was identified first with the bearing industry with the Gurney Ball Bearing Co. and later as director of sales and engineering with the United States Ball Bearing Co.

Upon the death of an associate, Bruenauer disposed of his ball bearing interests and became affiliated with the All American Truck Co. of which he was vice-president and acting general manager until he made his present connection.

Bruenauer has appointed Everett J. Cook chief engineer of the axle company. Cook formerly was in the engineering department of the Packard Motor Car Co. and then went with the Wisconsin Motor Parts Co. at Oshkosh as chief engineer.

The Standard Axle plant has been removed to 1300 Fletcher Street, where there is an ultimate capacity for 12,000 worm drive axles a year.

W. P. PRESSINGER DIES

NEW YORK, June 21.—The death is announced of Whitfield P. Pressinger, vice president of the Chicago Pneumatic Tool Co., as the result of complications following an operation. He was actively engaged in the pneumatic tool and allied industries for many years.

Calendar

SHOWS

- Aug. 23-27—San Francisco, National Traffic Officers' Safety First Exposition, Auditorium, C. De Witt De Mar, Manager.
- Oct. 6-16—New York, Electrical Show, Grand Central Palace, George F. Parker, Manager.
- Dec. 10-18—New York, Motor Boat Show, Grand Central Palace.
- Jan. 8-15—New York, National Passenger Car Show, Grand Central Palace, Auspices of N.A.C.C.
- Jan. 29-Feb. 4—Chicago, National Passenger Car Show, Coliseum, Auspices of N.A.C.C.

FOREIGN SHOWS

- June 26-July 25—Commercial vehicles, tractors, camions and engines, Antwerp.

July 9-20—London, England, International Aircraft Exhibition, Olympia, The Society of British Aircraft Constructors.

Aug. 7-Sept. 15—Motorcycles, sidecars, etc. Antwerp.

October—London, Commercial Vehicle Show, Olympia.

November—London, Passenger Car Show, Olympia.

CONTESTS

July 4—Tacoma, Wash. Speedway.

July 4—Hanford, Cal. Dirt track.

July 4—Spokane, Wash. Dirt track.

July 5—Batavia, N. Y. Dirt track.

July 17—Warren, Pa. Dirt track.

July 24—Watertown, N. Y. Dirt track.

July 31—Fulton, N. Y. Dirt track.

Aug. 7—Erie, Pa. Dirt track.

Aug. 14—Buffalo, N. Y. Dirt track.

Aug. 20-21—Middletown, N. Y. Dirt track.

Aug. 21—Johnstown City, Pa. Dirt track.

Aug. 21—Elgin, Ill. Road race, Chicago Automobile Club.

Aug. 28—Canandaigua, N. Y. Dirt track.

Aug. 27-8—Flemington, N. J. Dirt track.

Sept. 5—Targa Florio Race, Sicily.

Sept. 6—Hornell, N. Y. Dirt track.

Sept. 6—Cincinnati, O. Speedway.

Sept. 6—Uniontown, Pa. Speedway.

Sept. 17-18—Syracuse, N. Y. Dirt track.

Sept. 25—Allentown, Pa. Dirt track.

Oct. 1-2—Trenton, N. J. Dirt track.

Oct. 8-9—Danbury, Conn. Dirt track.

CONVENTIONS

Aug. 10—Niagara Falls, Ont. Automotive Metal Wheel Ass'n. Clifton House. Standardization Discussions.

Sept. 16-17—Cleveland, Motor and Accessory Manufacturers' Ass'n. Credit Convention.

Rhode Island Plans \$500,000 Road Season

PROVIDENCE, June 19—Joining in the campaign of highway building now sweeping the country, Rhode Island comes into line with road projects exceeding in magnitude anything ever before attempted here. The State is in the midst of a "Federal aid" program involving \$1,281,942.36 expenditure. It is also on the second portion of a three-year "highway act," which gives \$250,000 annually, and still there is left the item of maintenance revenues of the department of the state board, bringing in, by estimate, \$742,000.

In actual results the work expected to be done this season, according to State Engineer Irving W. Patterson, will probably be in the neighborhood of \$500,000, this figure being much beyond what has been laid out in any year before. Cities and towns will expend local money in amounts that would roll up a considerable total if they could be put together.

Nine big State highway undertakings are under construction at the present time. These, when completed, will add about 23 miles of macadam to the mileage in the State. The importance of this is enhanced, however, by the fact that the pieces of road being built are intended to fill up "gaps."

Massachusetts Creates Aeronautic Board

BOSTON, June 18—All aircraft operating in Massachusetts must be registered and display an identification number, according to a ruling which has been approved by the Governor and his council. Up to the present time no effort has been made to enforce laws enacted last year, but the increasing number of flying machines in the air each day has caused legislators and public authorities to act.

The first step taken is the creation of a board to pass upon all applications for

pilots' licenses and airplane registration. This board will operate under the department of public works, and its members will be men interested in flying, serving without pay. Precautions will be taken to prevent passenger carrying by inexperienced pilots.

Other duties of the board will be to investigate complaints and enforce reasonable rules of the air. It is not the intention of Commissioner John N. Cole to establish an aerial police force.

Electric Makers Sign for Exposition Space

NEW YORK, June 21—Several manufacturers of electric vehicles already have accepted invitations to have exhibits at the New York electrical exposition which will be held at Grand Central Palace Oct. 6-16. These displays will be grouped together this year.

Among the electric vehicle manufacturers who will exhibit are the Baker R & L Co., the Commercial Truck Co. of America, Lakewood Engineering Co., the Lansden Co., the Oneida Truck Co., Steinmetz company, Walker Vehicle Co., and the Ward Motor Vehicle Company.

TO SELL ACCESSORIES ABROAD

CHICAGO, June 19.—American motor accessories and equipment will be handled by a new selling organization which has been formed by the County Chemical Co., Ltd., of Birmingham, England. The new organization will function under the name of British Sales, Ltd., but will be run in connection with the parent corporation.

The Chemical company is one of the oldest established automobile accessory jobbing concerns in England and is in close touch with the trade throughout Great Britain. The company also plans to enter the American market with the sale of British made accessories. J. Roland Ray Co., Conway Bldg., Chicago, are American representatives of the company.

Harvard Plans Course for Student Aviators

CAMBRIDGE, MASS., June 19—In order that Harvard may still be represented creditably in intercollegiate aeronautics after the ex-service men have left college, plans have been made to train novices in the sport next fall. Most of the college's experienced air men will be graduated this year or at the end of next.

Col. L. H. Drennan of the northeastern department plans that college men will be trained at summer aviation camps in three periods of six weeks each, and will receive their reserve commissions at the end of the third summer. If this is approved by the army aviation committee, there will be a constant supply of well-trained flyers to fill the gaps made by graduation. According to Colonel Drennan's plan the college men would receive \$75 a month pay and would take the course after their freshman, sophomore and junior years.

At present there are about 60 members of the Aeronautical Society at Cambridge, most of whom were trained during the war. Of this number more than half will receive degrees this commencement and the remainder will be graduated next spring.

RICKENBACKER ON OHIO BOARD

COLUMBUS, June 21.—Captain Edward V. Rickenbacker has been named a member of a State aviation commission by Governor Cox. The function of the commission, which is said to be one of the first in the United States, is to direct a campaign for safety in air navigation and to formulate rules to govern flying. The legislature will be asked to pass an act giving legal status to the commission. Other members are John R. Gameter, Akron; Col. Frank Hunter, Columbus; C. F. Kettering, E. H. Talbott, and Col. E. A. Deeds, Dayton, and Rex L. Uden and F. B. Stearns, Cleveland.

RUSCO CLUTCH FACINGS



They are dependable. This has been proven by their actual use on automotive vehicles of all kinds, from heavy truck to speedy roadster, in congested city traffic and on hilly country roads.

Grips Strongest—Wears Longest

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An exclusive feature of *Fafnir Ball Bearings* is to be had in the design and construction of the *Fafnir Patented Pressed Steel Ball Retainer* illustrated above. We would call attention to the following points of superiority:—

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- (2) The balls are guided at their *rotating axes*, resulting in a practically frictionless retainer.
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AUTOMOTIVE INDUSTRIES

THE AUTOMOBILE

THE CLASS JOURNAL COMPANY
239 WEST 39th STREET NEW YORK CITY

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WYMAN-GORDON
The CRANKSHAFT MAKERS
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The Area Contact in Gurney Bearings

A ball in a Gurney Ball Bearing does NOT have "Point contact."

Because the contour of the Gurney races very closely approaches that of the balls, and because all balls are slightly compressed under load, a larger portion of their circumference coincides with the contour of the raceways. Thus the spots of contact are of quite an appreciable area, and increase at a rapid rate with increased load.

In fact, in some Gurney Bearings each ball is capable of carrying as much load with safety as 26 balls of this same size rolling between two plane surfaces.

The Gurney Idea of "area of contact," together with the Gurney Method of assembling which permits maximum size and number of balls, accounts for the greater load capacity of Gurney Ball Bearings.

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THE problems of the automotive industry have demanded a productive capacity and a development of the product which has placed the factory methods, the standardization of parts, and the use of production machinery far in advance of other industrial fields in many respects.

For this reason the methods which are applicable to the heavy metal trades operations may not have any significance to the automotive producer.

This applies just as much to an advertiser who is interested in bringing his product to the notice of an automotive manufacturer as it does to an editor who is considering the best practice and the value of the tendencies in the field.

AUTOMOTIVE INDUSTRIES has always endeavored to produce a publication which could be considered authoritative, and in which the advertising pages would agree with the objects for which the publication exists. We are pleased, therefore, to get the comment that the advertisements in AUTOMOTIVE INDUSTRIES show equipment engaged upon the character of work which the reader expects them to perform in his own plant. This expression from a subscriber to AUTOMOTIVE INDUSTRIES is gratifying because it indicates that the whole of the publication is applied strictly to the automotive field and the necessities of the field.

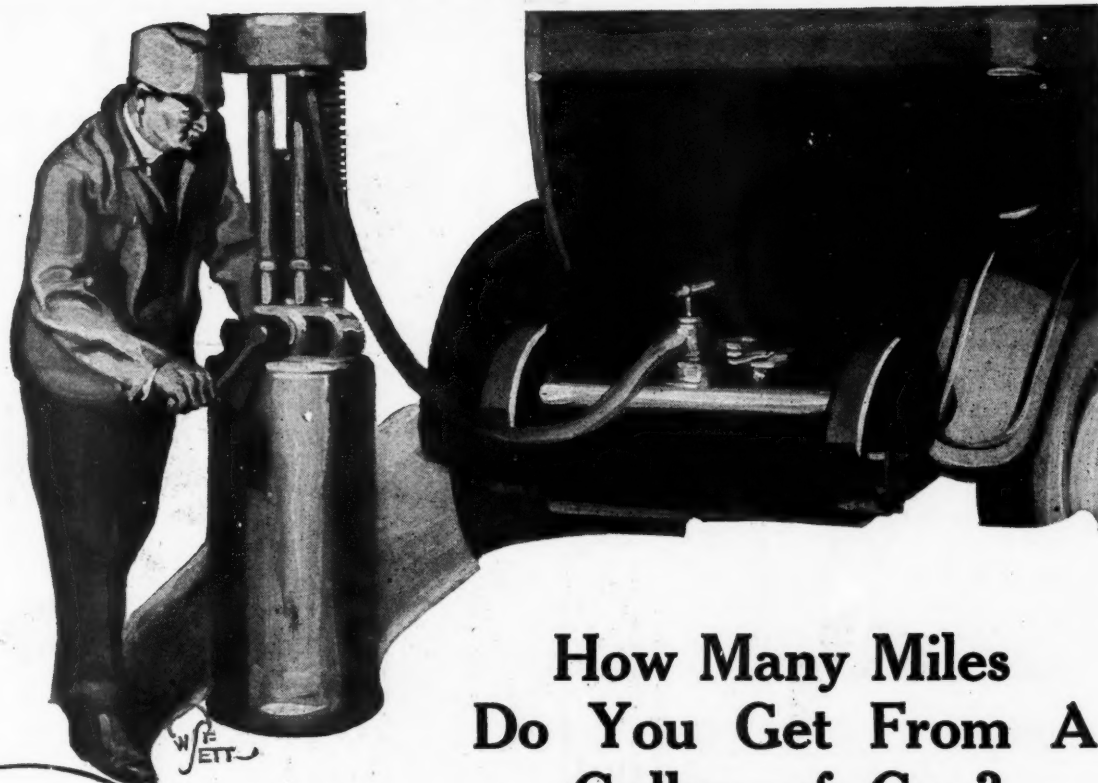


At the vital spot

All the rugged strength of a good bearing will not save it from the junk heap if it is run while out of adjustment. Laminated shims make accurate bearing adjustments easy. Simply peel 'em down to fit.

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How Many Miles Do You Get From A Gallon of Gas?

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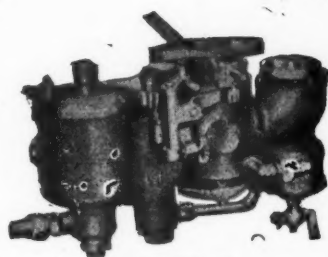
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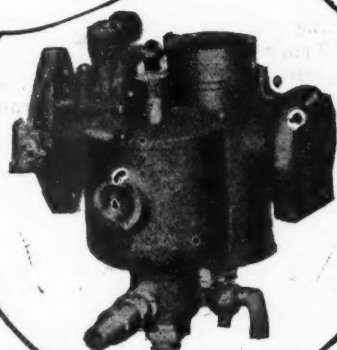
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21st and Rockwell Sts., Chicago, Ill.

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MODEL M

RAYFIELD

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Integrity is the realization of a high ideal in actual performance—a perfect balance—as exemplified in the design and performance of Clark Axles for Motor Trucks.

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For Motor Trucks

Milwaukee Milling Machines

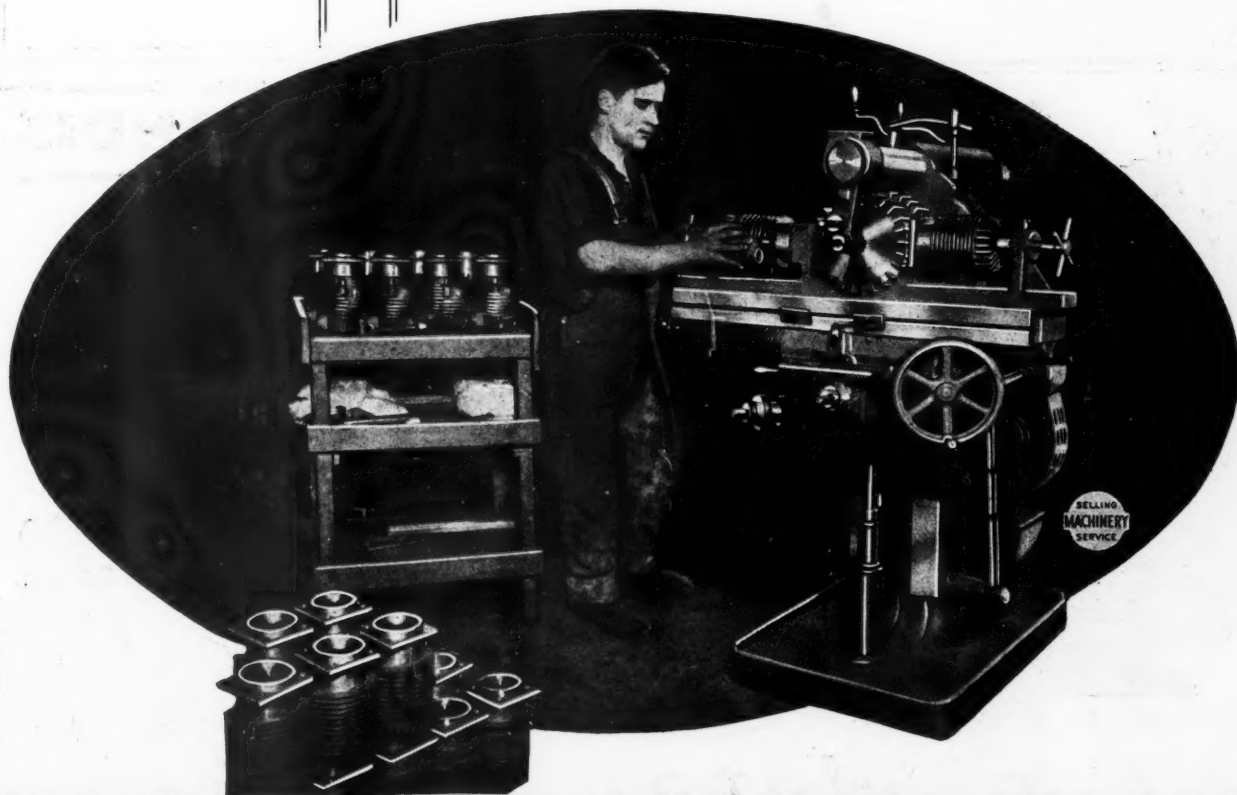
Reciprocal, Manufacturing Milling

The illustration shows a Milwaukee Milling Machine milling gray iron motor-cycle engine cylinders at the rate of 300 per day in the plant of the Harley-Davidson Motor Co., Milwaukee.

A cut $3 \frac{15}{16} \times \frac{3}{8} \times \frac{1}{8}$ in. deep was taken on each of the four sides of the castings. Two 10-in. diameter side milling cutters were used and two sides finished at one time. Two cylinder castings were carried by the double fixture. While the cutters were operating on one casting, the other cast-

ing was taken out and replaced by an unfinished one so that the operation was practically continuous. A Milwaukee No. 1-A Manufacturing Milling Machine was used. It will be noticed that this machine has a single overarm. All latest machines have the double overarm. Are you acquainted with Milwaukee features? For instance, the automatic flooded lubrication system, cutter lubricating system, solid top, box section knee, constant speed drive, etc.

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People ask "Why do you get so much greater production with LANDIS Grinding Machines?" The reasons are to be found in LANDIS design. This 10" x 24" Plain Grinder, for example, can be operated with the speed of an automatic machine. Its design is correct; the working parts are all on the inside; the operating levers are all on the outside; the grinding wheel travels and the work table is stationary—these are a few of the reasons why the LANDIS is the "Machine for Production."

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of this and other LANDIS grinding machines—
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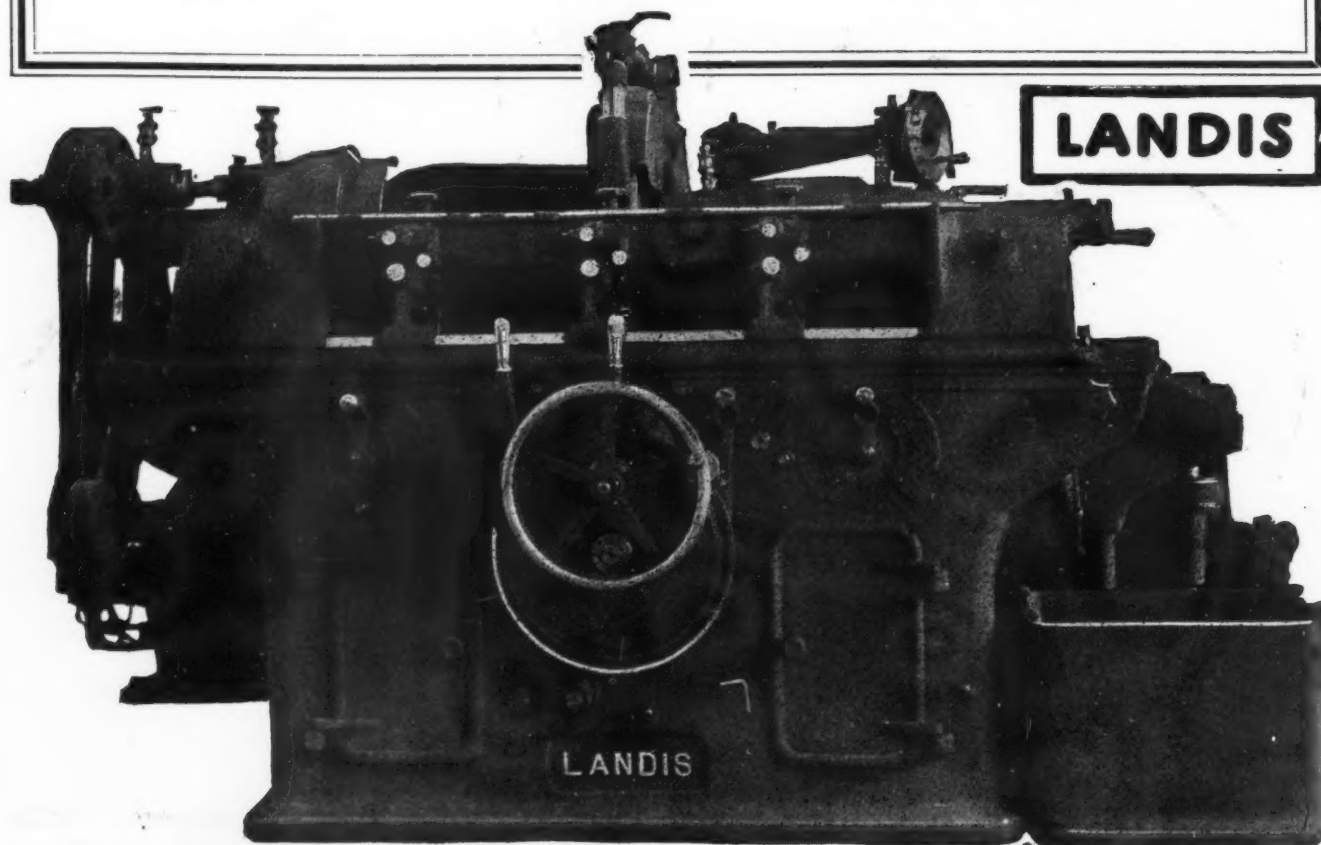
Dewstoe Machine Tool Co., Birmingham.
Elliott & Stephens Machinery Co., St. Louis.
F. C. Richmond Machinery Co., Salt Lake City.
Hallidie Machinery Company, Seattle.

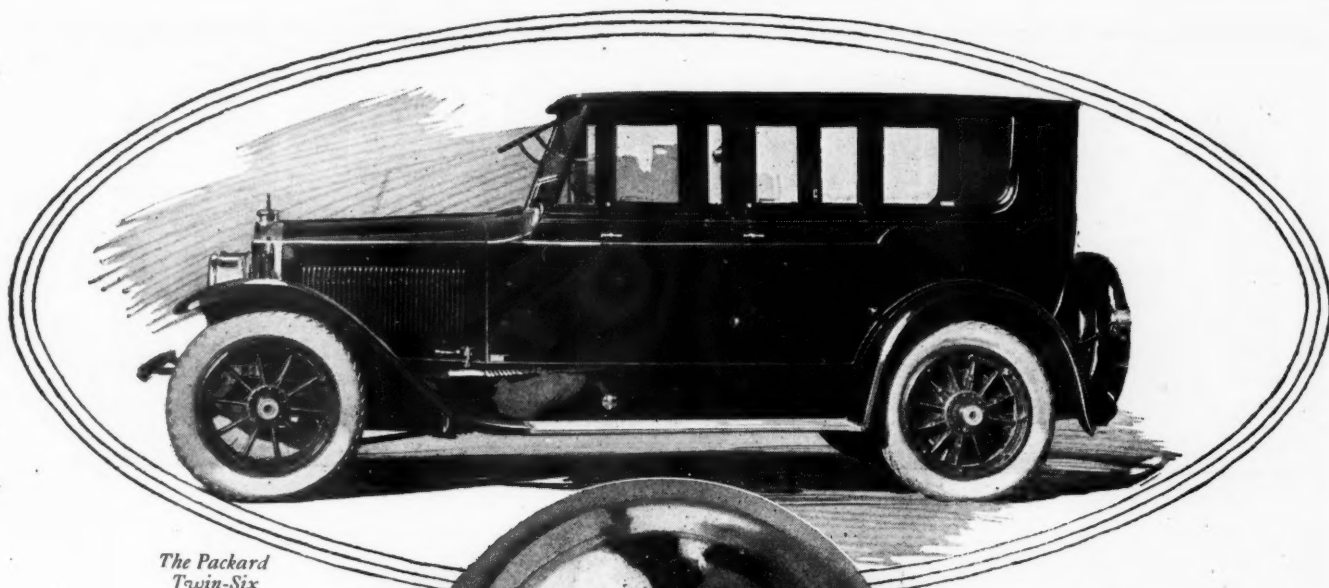
Harron, Rickard & McCone, San Francisco and Los Angeles.
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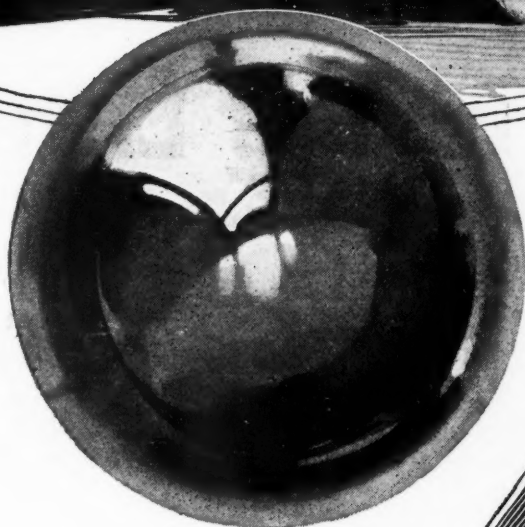
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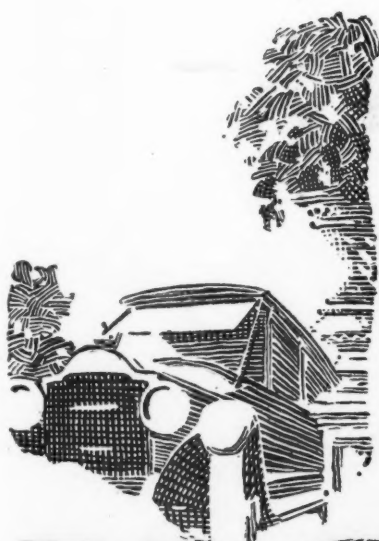
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THE riding comfort of a deeply cushioned pullman, in motor cars, is obtained from ball bearings working on toy-like steel balls, which soothe the disturbing elements.

Perfectly round and velvety smooth steel balls evolved from intensive research and manufacturing experience, is the Hoover Steel Ball's contribution to your riding comfort.

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TURRET LATHES

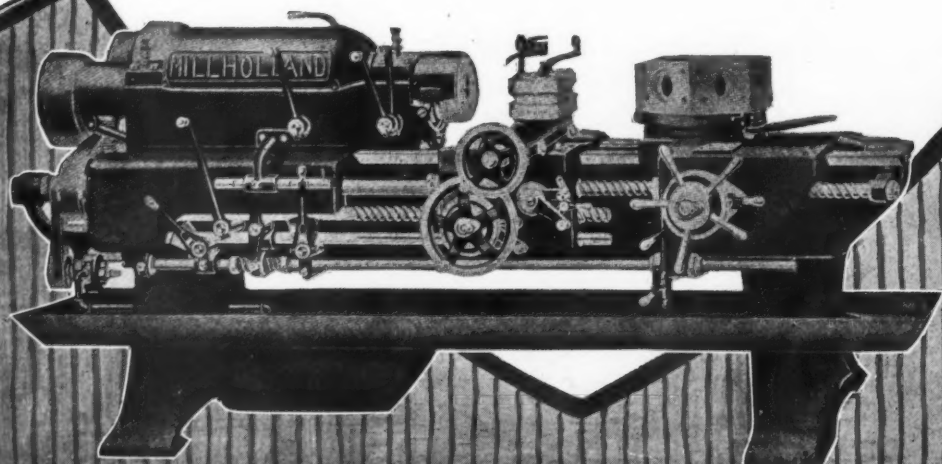
The Millholland 31½x36 Manufacturing Turret Lathe, illustrated below, is of exceptional value to manufacture where unskilled labor has had to be introduced to offset skilled labor shortage.

It is of massive construction with large bearing surfaces. All parts are of substantial design and the mechanism is so fool-proof that the machine is practically indestructible. The levers are few in number and easily accessible for the operator.

A study of the specifications, equipment and details of construction of the Millholland Manufacturing Turret Lathe will bring out the desirable points for consideration in any mass-production problem. If such a matter is now up for solution, the Millholland Lathe will solve it effectually and economically.

Millholland Machine Co.

Agents in All Principal Buying Centers



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TURRET SCREW MACHINES

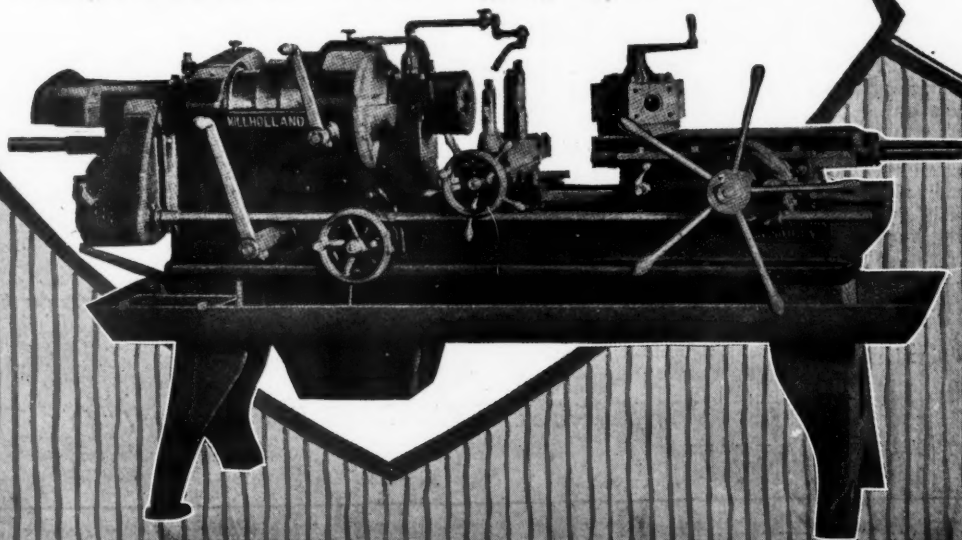
A combination of high speed, extreme accuracy and simplicity of operation are offered the Automotive Industry in the Millholland Turret Screw Machine.

In addition to rigidity and accurate construction, the outstanding feature of the Millholland Turret Screw Machine is the design of the double friction, back geared headstock. By shifting two friction levers on the headstock, three spindle speeds are instantly available for each step of the cone—nine in all—which can be made with the spindle running at any speed.

Multiple operations, such as turning, boring, facing and grooving at one time used for the longest operation, are possible with the Millholland Turret Screw Machine. Investigate this machine and its possibilities. It will open the way for greater and more economical output.

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MACHINES

OBERTING MOTOR

SPECIFICATIONS

Cylinders — 4, cast en-bloc.

Bore — $3\frac{1}{4}$ inches — stroke $5\frac{1}{4}$ inches.

Valves — Extra large $1\frac{1}{2}$ inch interchangeable in removable head, which is held in place by 10 heat treated steel studs.

Push Rods — Tubular, ball and socket. (Note valve adjustment nut and screw on top.)

Crankshaft — 40 carbon steel, 3 babbitt bearings — counter-balanced. Diameter $2\frac{1}{4}$ inches.

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Oiling — Force feed and splash system. Has many unusual service features.

Flywheel — 16 inches diameter cast iron, semi-finished. Machined for single plate disc clutches. Starting motor flange provided.

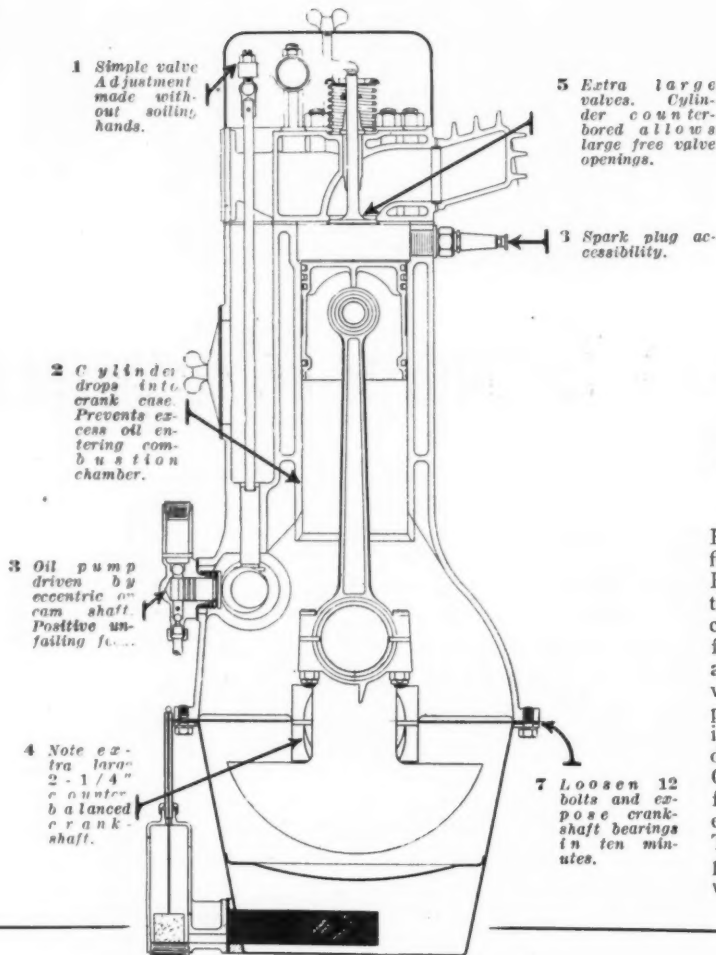
Cooling — Thermo-siphon system, extra large water inlet and outlet passages.

Timing Gears — Spiral type, 1 inch face, 8 pitch.

Valve System — Enclosed in aluminum cover, oil, dust and dirt proof.

Intake Manifold — A special feature. Cast in head requiring no hot spot or other pre-heating device.

Magneto — Optional.
Carburetor — Optional.



Flexibility—Power

Here is a revelation in flexibility and power. From the soft purr of the idling engine to the compelling roar of its fully expressed power is a wide range of speed variations. And so it picks up its load, swinging into smooth silent demonstration. The Oberting Motor gets the fullest expression from every ounce of fuel. This economy-plus-power feature is well worth considering.

In Assemblage only four sizes of nuts are used and so simple is the engine that it may be entirely dismantled and rebuilt by two men in less than two hours. Crank shaft bearings can be exposed in ten minutes.

This feature of Oberting design is well worth considering when the matter of selecting the proper motor arises. Quick accessibility such as this marks another step forward in motor development.

Especial attention is also called to the oiling system on the Oberting motor. We use the combined splash and force feed, with improvements which guarantee full automatic lubrication of every moving bearing part.

The valve-in-head arrangement gives over-sized valves and maximum even compression in all cylinders.

The intake manifold is cast directly on the cylinder head.

This makes all pre-heating devices unnecessary. The fuel is thoroughly broken up and heated just as it enters the combustion chamber. This is accomplished through the position of manifold and an interior "breaking up" device. The importance of such a form of design is very obvious.

The Oberting motor is a splendid creation of simplicity, accessibility and endurance. A full investigation will bring out its many service features in detail.

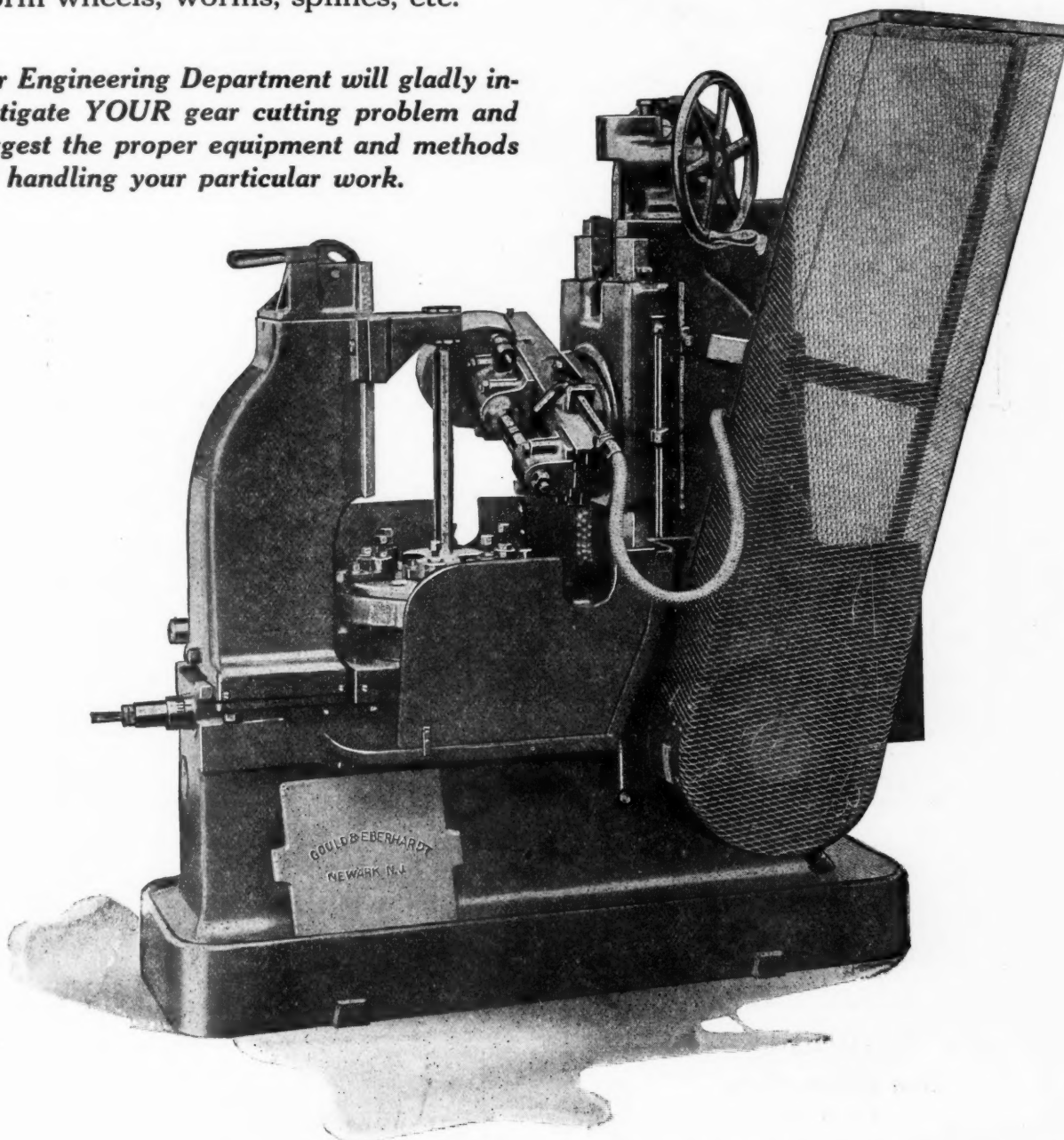
Car, truck and tractor designers can have full information on request. Write for it, and send your requirements for next year's production.

THE OBERTING MOTORS CO.
CLEVELAND OHIO

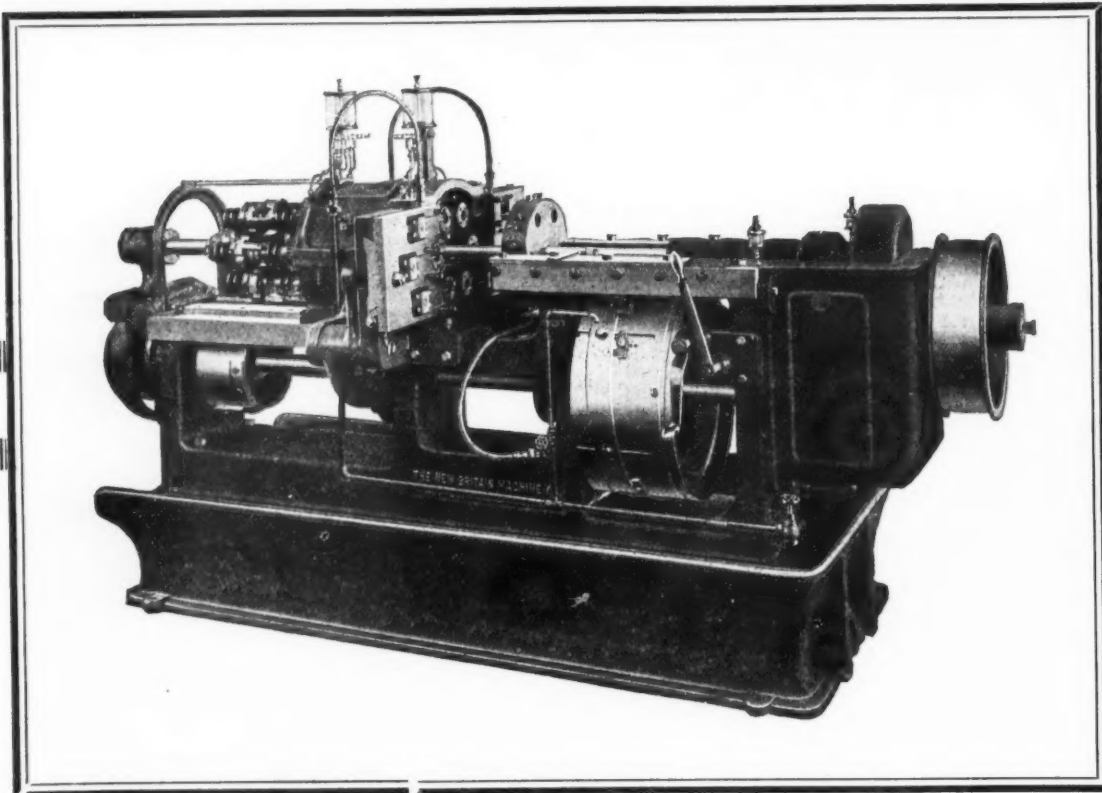
G. & E. Hobbing Machines Are Noted For Their Strength, Accuracy and Speed!

THE GOULD & EBERHARDT 18-H Gear Hobbing Machine is especially designed for *accurate* and *rapid* cutting of transmission gears, fly wheels or starter rings, timing gears, sprockets, clutch discs, steering worm wheels, worms, splines, etc.

Our Engineering Department will gladly investigate YOUR gear cutting problem and suggest the proper equipment and methods for handling your particular work.



GOULD & EBERHARDT
"HIGH DUTY" SHAPERS
AUTOMATIC GEAR AND RACK CUTTING MACHINERY
ESTABLISHED 1833
NEWARK, N.J. U.S.A.



780 STUD BLANKS Per Hour

The
New Britain
Machine
Company
New Britain, Conn.
U. S. A.



AS a job of machining this *stud blank* presents no tooling difficulties whatever.

Its interest lies in its very *simplicity* and the resultant possibilities for *rapid production*.

Formerly work of this character was turned out *one-at-a-time* in *single-spindle* automatics.

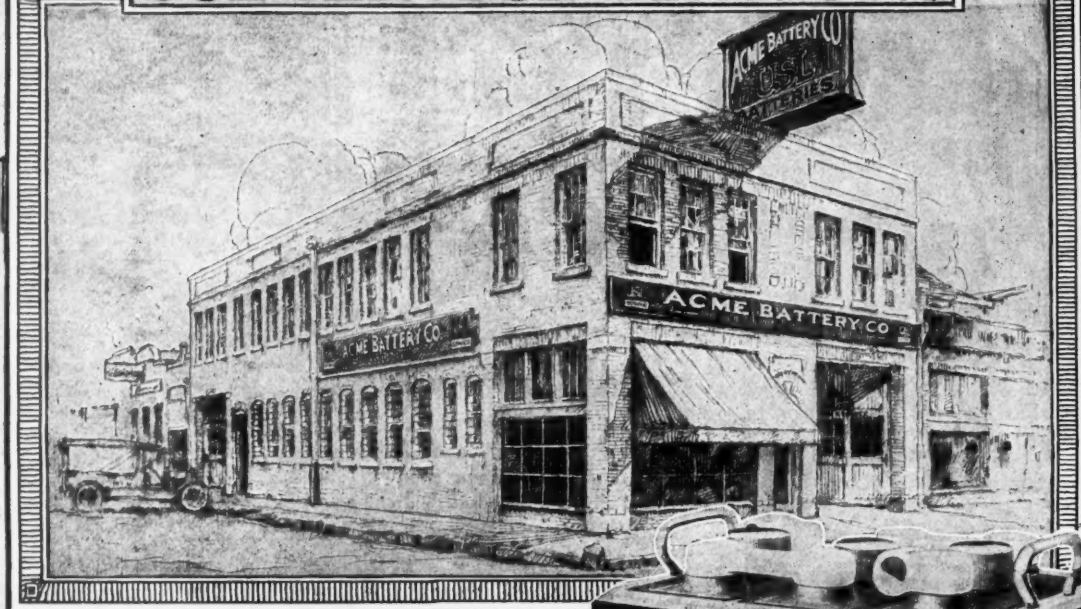
To-day it is being handled *six-at-a-time* in "*New Britain*" *Sextuple Automatic Bar Machines* at a rate practically *six-fold* that previously obtained.

To its capacity for greatly *increasing production* add the saving in *floor space* and *first cost of machines*, and you have the secret of the New Britain's rapid adoption on such work as *nuts, sleeves, rolls, pipe couplings, piston pins*, and other jobs requiring drilling, facing, chamfering and cutting off only.

Perhaps you have machines tied up on simple jobs which could more profitably be used on other work. We'd like to look into the subject with you. Write for Bulletin No. 955.

NEW BRITAIN AUTOMATICS

USL SERVICE STATIONS



THOUSANDS of Garages, Automobile & Accessory Dealers

are making *extra* money selling
USL Batteries.

The USL Battery-Sales Plan
gives the Automobile Trade
their rightful recognition. Re-
charging and repair work may
be done in your own shop or
at a USL Golden Rule Service
Station.

May we send you the booklet
that tells you all about it?

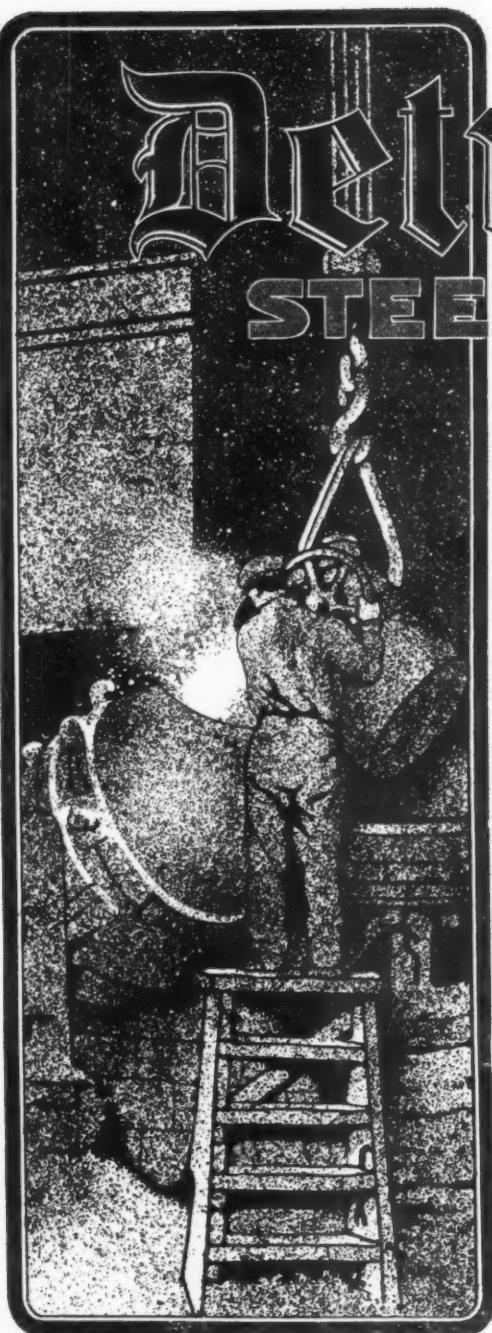
U.S. Light & Heat Corporation
Niagara Falls N. Y.



*Acme Battery Co.,
Dallas, Texas.
One of the chain of nation-wide
USL Service Stations.*

USL
TRADE MARK
U. S. LIGHT & HEAT CORPORATION

storage
batteries



Detroit

STEEL CASTINGS

In the final analysis it is the regular day-in-and-day-out jobs that are turned out under the Triangle "D" Brand that impresses the user with the consistent quality of Detroit Castings.

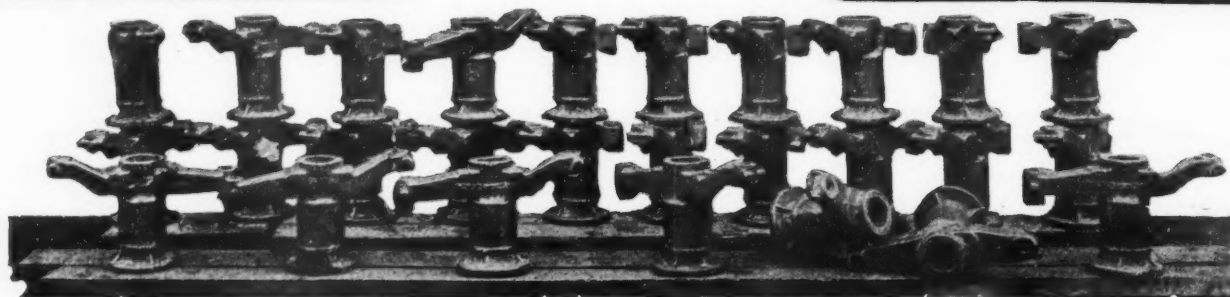
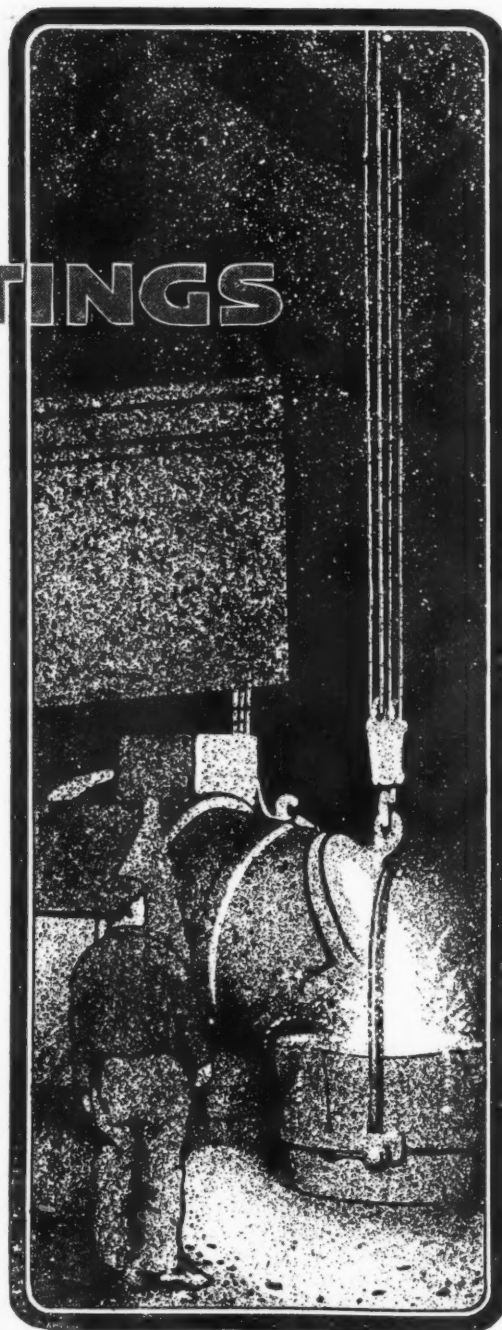
The brake blocks shown below represent one of the many regular parts turned out for the builder of a leading car and truck—a company noted for the high and consistent quality of their product.

Castings from two ounces to twenty-one tons. Both the converter and open hearth methods used.

**DETROIT STEEL
CASTING CO.**

Detroit

Mich.



The Hendey Operator Can Focus All His Attention on the Work

The real underlying reason why Hendey Lathes are the universal lathe favorites in toolrooms everywhere, entirely aside from their precision, is the fact that the operator's entire attention can be devoted to the work in hand. Any machine that requires continuous attention is more of a hindrance than an aid. The Hendey is so handily operated and the tools so easily brought in contact with the work that un-

divided attention to the actual turning of the piece is assured.

That's why the skilled toolmaker, the ambitious toolroom foreman, the work-speeding production manager and the forward-looking shop executive place so much confidence in Hendeys.

If you as a machine tool buyer don't know Hendeys—INVESTIGATE!

HENDEY MACHINE COMPANY

Torrington,

Conn.

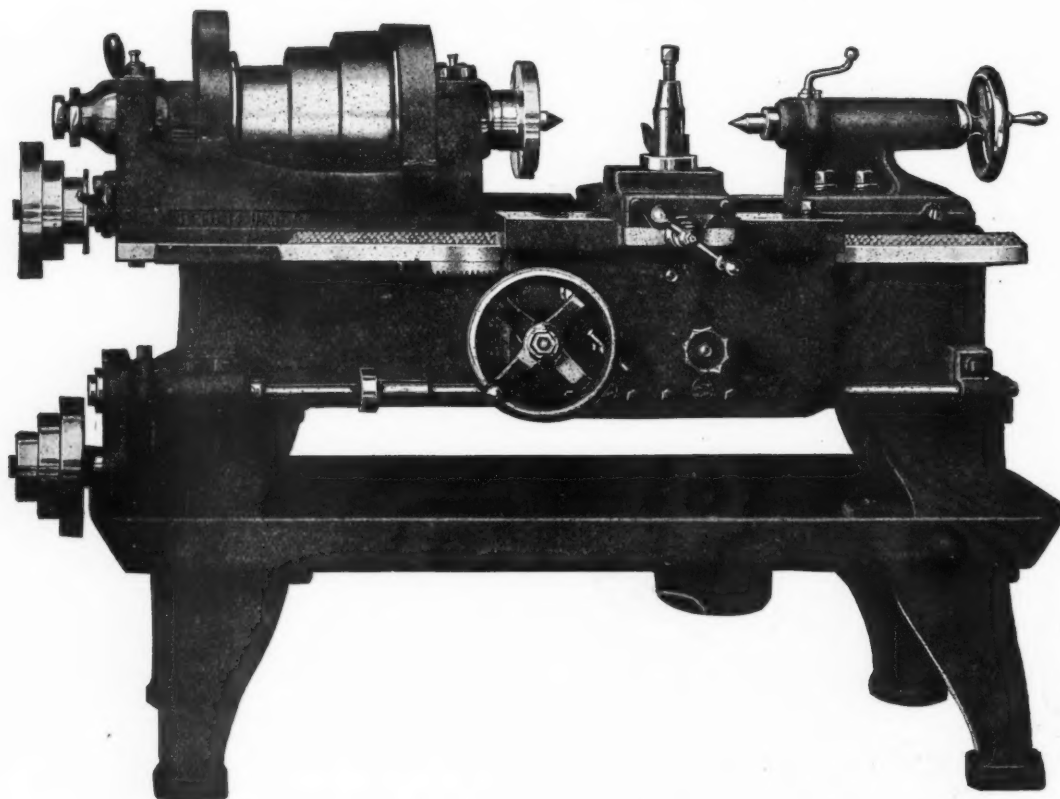
Singer Bldg., New York City
Oliver Bldg., Boston, Mass.

C. of C. Bldg., Rochester, N. Y.
618 Washington Blvd., Chicago, Ill.

LATHES ===== **SHAPERS** ===== **MILLERS**



HENDEY

REED-PRENTICE COMPANY**WORCESTER****Mass. U.S.A.****“A PUNCH WITH WEIGHT BEHIND IT”—**

THIS 14" EXTRA HEAVY PLAIN TURNING LATHE IS BUILT WITH TWO TYPES OF HEAD—EITHER THE SINGLE BACK-GEAR AS SHOWN IN THE PHOTOGRAPH OR WITHOUT BACK-GEARS, BUT WITH A FRICTION CLUTCH AND BRAKE FOR QUICK START AND STOP OF SPINDLE.

A GREAT MANY INDUSTRIES HAVE USE FOR A ROUGH TURNING LATHE OF THIS SORT WHICH HOGS OFF STOCK QUICKLY AT LOW COST.

THIS REED-PRENTICE HAS A REPUTATION OF SPLENDID WORTH ESTABLISHED BY FOURTEEN YEARS OF CONSTANT HARD WORK.

WE WOULD LIKE TO HAVE THE PLEASURE OF EXPLAINING TO YOU ITS PRESENT EFFECTIVENESS.


MANNING, MAXWELL & MOORE, INC.

NEW YORK, BOSTON, NEW HAVEN, PHILADELPHIA, WASHINGTON, BUFFALO, MILWAUKEE,
CLEVELAND, CINCINNATI, CHICAGO, ST. LOUIS, SEATTLE,
SAN FRANCISCO, DETROIT.

REED-PRENTICE CO.
EXPORT OFFICE
GRAND CENTRAL PALACE
NEW YORK

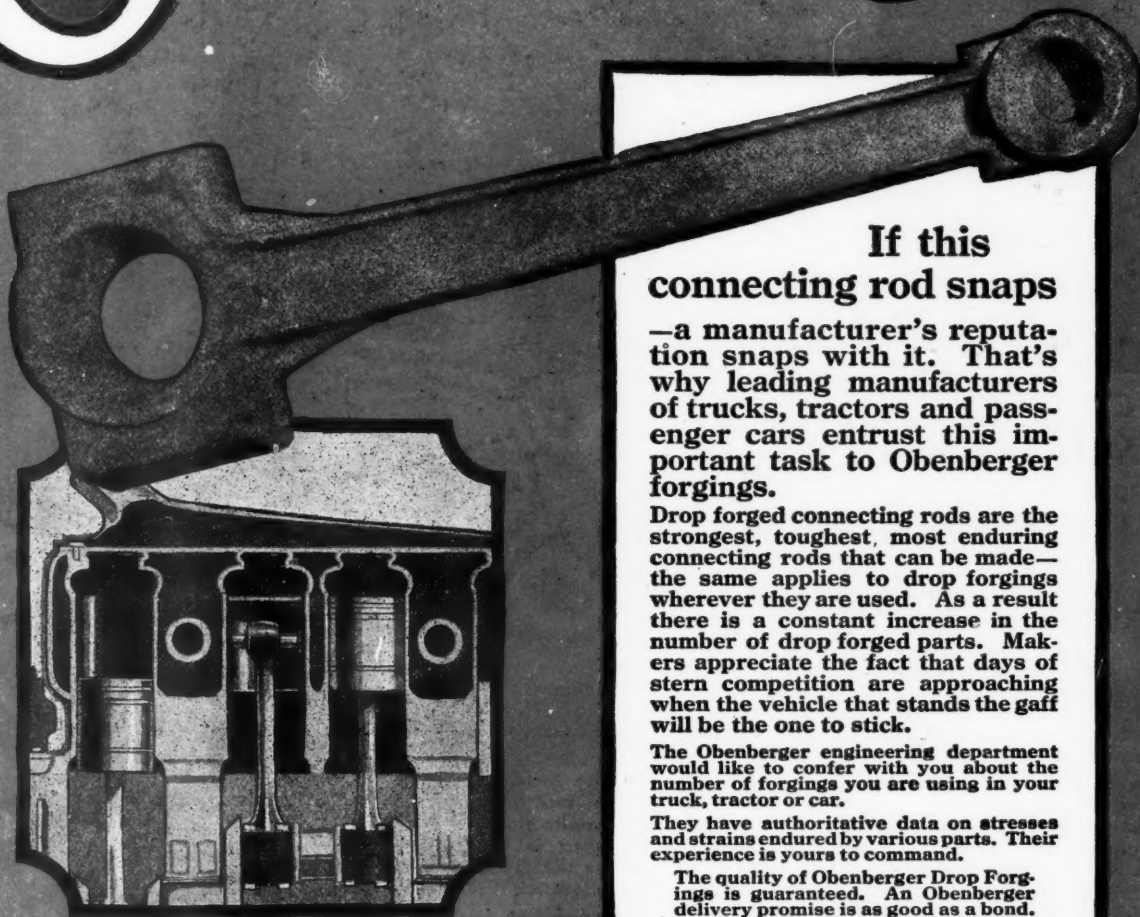
CANADIAN FAIRBANKS-MORSE CO., LTD., CANADA
FENWICK FRERES—FRANCE

REED-PRENTICE CO
DETROIT OFFICE
MAJESTIC BLDG.



Obenberger

Look for the name on high grade forgings



If this connecting rod snaps

—a manufacturer's reputation snaps with it. That's why leading manufacturers of trucks, tractors and passenger cars entrust this important task to Obenberger forgings.

Drop forged connecting rods are the strongest, toughest, most enduring connecting rods that can be made—the same applies to drop forgings wherever they are used. As a result there is a constant increase in the number of drop forged parts. Makers appreciate the fact that days of stern competition are approaching when the vehicle that stands the gaff will be the one to stick.

The Obenberger engineering department would like to confer with you about the number of forgings you are using in your truck, tractor or car.

They have authoritative data on stresses and strains endured by various parts. Their experience is yours to command.

The quality of Obenberger Drop Forgings is guaranteed. An Obenberger delivery promise is as good as a bond. Obenberger facilities insure prices that are right. Send your blue prints for quotations.

**JOHN OBENBERGER
FORGE COMPANY**

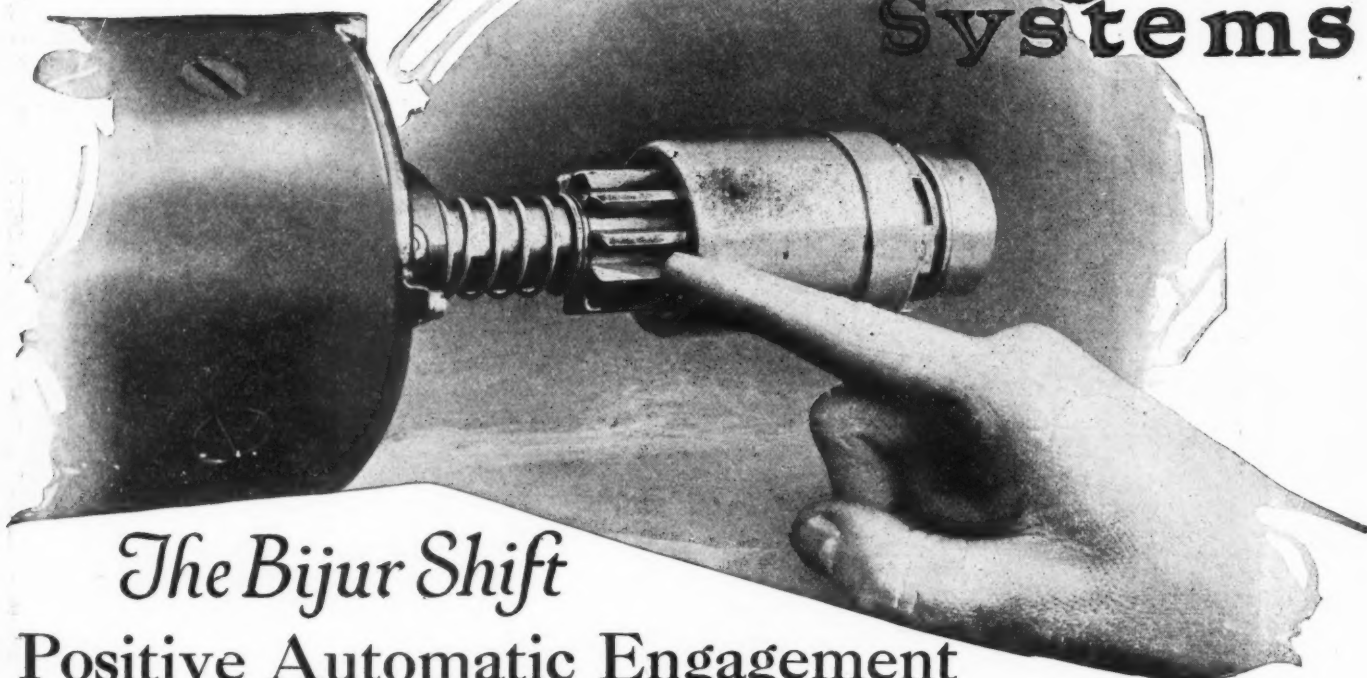
West Allis, Milwaukee, Wis.



Forgings

Bijur

Starting & Lighting Systems



The Bijur Shift

Positive Automatic Engagement

*A "start" with a Bijur Shift
is a Sure Start—never a jam*

The enormous advantage of engaging the starting motor with the flywheel automatically by merely pressing the starting switch has brought this system into wide use in spite of the defects of the engaging mechanism used before the Bijur pinion shift was introduced.

The collection of levers to shift the pinion, drop the brushes, make switch contacts, etc., found on earlier models, has been discarded and a simple small starting switch with no complications, is placed in a position where it can easily be reached in the circuit of heavy cable between battery and motor; thus the faults of imperfect engaging mechanism need no longer be tolerated.

In the Bijur shift the pinion is not internally threaded but is smooth bore, and slides on a smooth shaft, along which it is pushed by a compression spring. A threaded nut pushes spring and pinion ahead of it into mesh with the flywheel but never reaches the latter. Hence the pinion cannot jam. On the contrary, when teeth occasionally meet end to end, the pinion presses against the flywheel with a light spring pressure, then snaps into mesh—does it 100%—10,000 times out of 10,000 with never a failure, and the wear in the flywheel teeth that arises from forcibly feeding the threaded pinion against the flywheel is eliminated.

The development made possible by the Bijur Shift means an increase of 25% in starting torque yet the starting motor remains the same size as before.

The Bijur line of starters includes the well-known, non-jamming, backfire and flywheel-breaking prevention features found only in the Bijur direct automatic shift design.

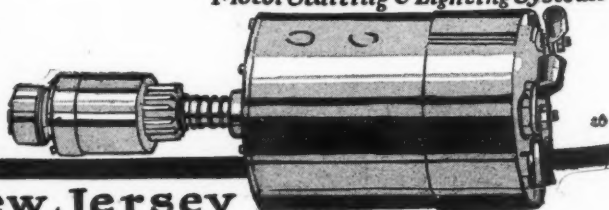
Why the Bijur Shift Excels

- Automatic Engagement
- Positive Engagement
- Small Motor Pinion
- Backfires Harmless
- No Pinion Jamming
- No Driving Spring
- Fully Enclosed
- Not Disabled by Oiling
- Shockless
- Noiseless
- Light Weight
- Current Economy
- Cold Weather Ability
- Harmless to Press Starting Switch with Engine Running
- No Intermittent Ticking of Pinions Against Flywheel
- Found only on Bijur Starting Systems

Bijur Motor

Appliance Company

Motor Starting & Lighting Systems



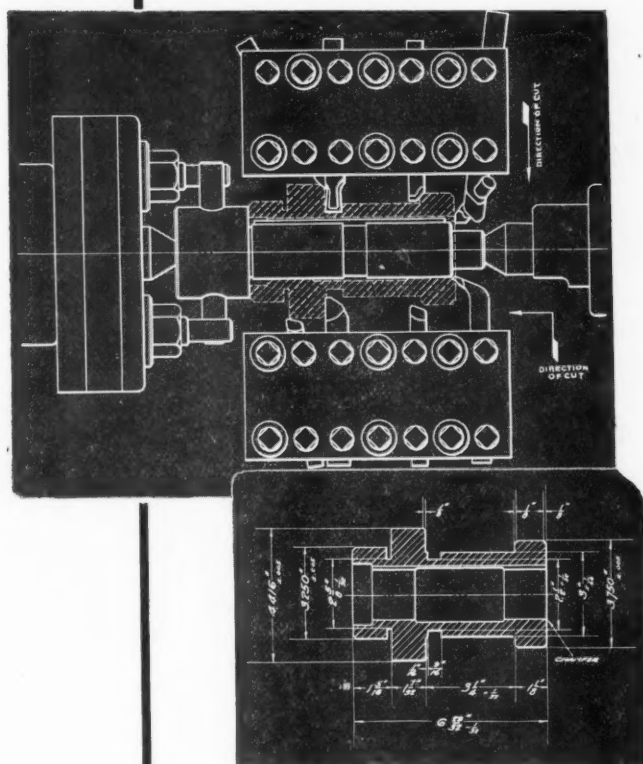
Hoboken



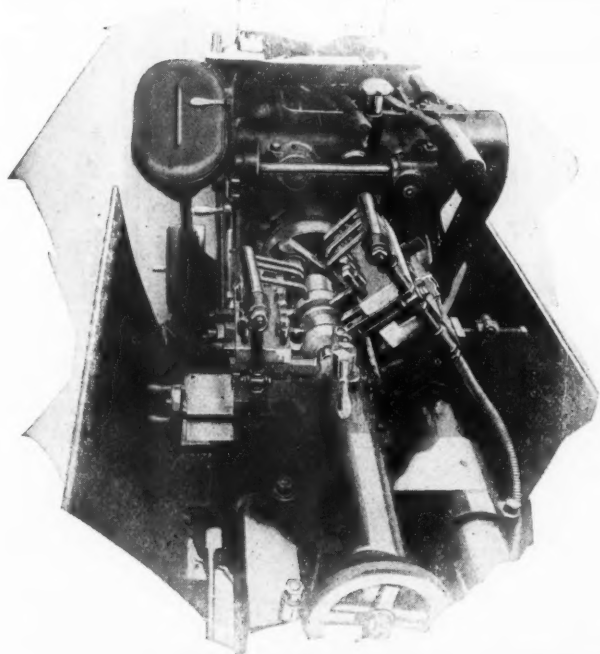
New Jersey

FAY AUTOMATIC LATHE

SECOND OPERATION



THE PIECE



*Fourteen Tools working
simultaneously finish
this piece in time it
takes to make longest
single cut*

The second Of Two Operations

This job is handled on two FAY Lathes, handled by one operator and represents the acme of multiple tooling.

The largest single cut determines the entire production time.

The FAY WAY has solved many a knotty production problem on an endless variety of turned parts.

Our engineers await your call in helping to solve your particular problems.

Send sample piece or blue-print.

Jones & Lamson Machine Co.
Springfield, Vermont

San Francisco, California, 503 Market Street; London, E. C., 109 Queen Victoria Street; France, Spain and Belgium, F. Auberty & Co., 91 Rue de Maubeuge, Paris; Japan, Korea, etc., Mitsui Bussan Kaisha, Ltd., Tokio; Holland, Spilthoff, Beeuwkes & Co., Leuvehaven, w.z. 159 Rotterdam; Australasia, McPherson's Pty, Ltd., Melbourne.

THE FAY WAY of MACHINING TRIPLE GEAR BLANKS

FOR THE FIRST OPERATION ON THIS JOB SEE OUR "AD" OF LAST WEEK



The Aeroplane—and “Barnes-Made” Springs

In an aeroplane the lives of those who fly—as, of course, the safety of the machine itself—depend primarily upon springs.

From the smallest springs in the controlling mechanism or magneto to the heaviest coil spring in the landing chassis, every one must be of an exact temper and quality to insure proper performance. Sufficient tensile strength to stand up under the grind of normal usage and sufficient ruggedness to withstand sudden emergency are factors of vital importance.

Throughout the entire development of the aeroplane, inventors and designers have specified “Barnes-Made” Springs for many of its most vital parts.

The Wallace Barnes Company

“Spring Makers for Three Generations”

Main Office and Works — Bristol, Conn.

Western Sales Division, Book Bldg., Detroit

Let's Use the Right Name

The name "Screw Machine" is no longer appropriate when applied to the modern Turret Lathe. It is seldom used for making screws—(automatics serve the purpose better for large quantities). Its field of work is as universal now as that of the engine lathe. Where bar work was almost the only product ten years ago, chucking work is now in the majority. Then, too, the modern Turret Lathe has in its design and construction characteristics and power to handle tough forgings and alloy steel parts that would be superfluous for making screws. The Automobile Manufacturer used them for machining pistons, hubs, steering arms, differential housings, and a number of other parts.

A natural reluctance to change a trade name so long used may be wise for a time, but we think the mechanical world prefers to call a machine by the name acquired by its evolution into a wider field, and not by the name of the limited field it occupied years ago.

The Screw Machine of yesterday is a Turret Lathe today. Let all users and manufacturers join with us in dropping the old term "Screw Machine" when applied to Turret Lathes.

The Warner & Swasey line consists of the

- No. 2—A Universal Hollow Hexagon Turret Lathe
(Bar Capacity— $2\frac{1}{2}$ " x 29" or $3\frac{1}{4}$ " x 29"—12" Chuck Capacity)
- No. 3—A Universal Hollow Hexagon Turret Lathe
(Bar Capacity— $3\frac{1}{2}$ " x 44" or $4\frac{1}{2}$ " x 44"—16" Chuck Capacity)
- No. 4 Universal Turret Lathe—(Capacity $1\frac{1}{2}$ " x 10"—16" Swing)
- Nos. 1 ($\frac{5}{8}$ " x 4")—2 (1" x 6")—4 ($1\frac{1}{2}$ " x 8") Plain Turret Lathes
- Nos. 2 (1" x 6")—4 ($1\frac{1}{2}$ " x 8")—6 ($2\frac{1}{4}$ " x 12") Geared Friction Head Turret Lathes
- Brass Turret Lathes—Brass Working Machine Tools

The Warner & Swasey Company

CLEVELAND, OHIO, U. S. A.

New York Office: Singer Building
Detroit Office: Ford Building

Boston Office: Oliver Building
Chicago Office and Show Room: 618-622 Washington Boulevard

Buffalo Office: Iroquois Building

DOMESTIC AGENTS:

Fulton Supply Company, Atlanta, Ga.
Young & Vann Supply Company, Birmingham, Ala.
Woodward, Wight & Company, New Orleans, La.
Salt Lake Hardware Company, Salt Lake City, Utah.
Smith-Booth-Usher Company, Los Angeles, Calif.
Fred Ward & Son, San Francisco, Calif.
Portland Machinery Company, Portland, Oregon.
Hallidie Machinery Company, Seattle, Wash.
Hendrie & Bolthoff Mfg. & Supply Company, Denver, Col.
Peden Iron & Steel Company, Houston, Texas.

CANADIAN AGENTS:

A. R. Williams Machinery Company, Ltd., Toronto, Winnipeg, Vancouver and St. John's.
Williams & Wilson, Ltd., Montreal.

FOREIGN AGENTS:

Charles Churchill & Company, Ltd., London, Birmingham, Manchester, Bristol, Newcastle-on-Tyne, Glasgow.
Allied Machinery Company, Paris, Turin, Zurich, Barcelona, Brussels.
Wilhelm Sonesson Company, Malmo, Copenhagen, Stockholm, Gothenburg.
R. S. Stockvis en Zonen, Rotterdam.
Benson Brothers, Sydney, Melbourne, Adelaide.
Yamatake & Company, Tokyo.
Anderson, Meyer & Company, Ltd., Shanghai, Tientsin, Peking, Hankow, Canton, Yunnanfu, Changchau, Kalgan.
Brossard-Mopin & Company, Saigon, Singapore, Haiphong.
McLeod & Company, Calcutta.



ONE hundred and twenty times per hour the Ohio Tilted Rotary automatically goes through a cycle of operations.

The operator puts in and takes out of the fixture, one hundred and twenty of the brackets shown below.

That's all the operator does.

Four inserted blade face mills mill the four surfaces indicated at the rate of 120 per hour—every hour.

The fixture has but two work-holding positions.

The material is malleable iron.

The rate of feed is 14.4 inches per minute.

OS. TERLEIN SAYS:

Why work four sets of cutters on four machines when the Ohio Tilted Rotary with one set of cutters can do the work?

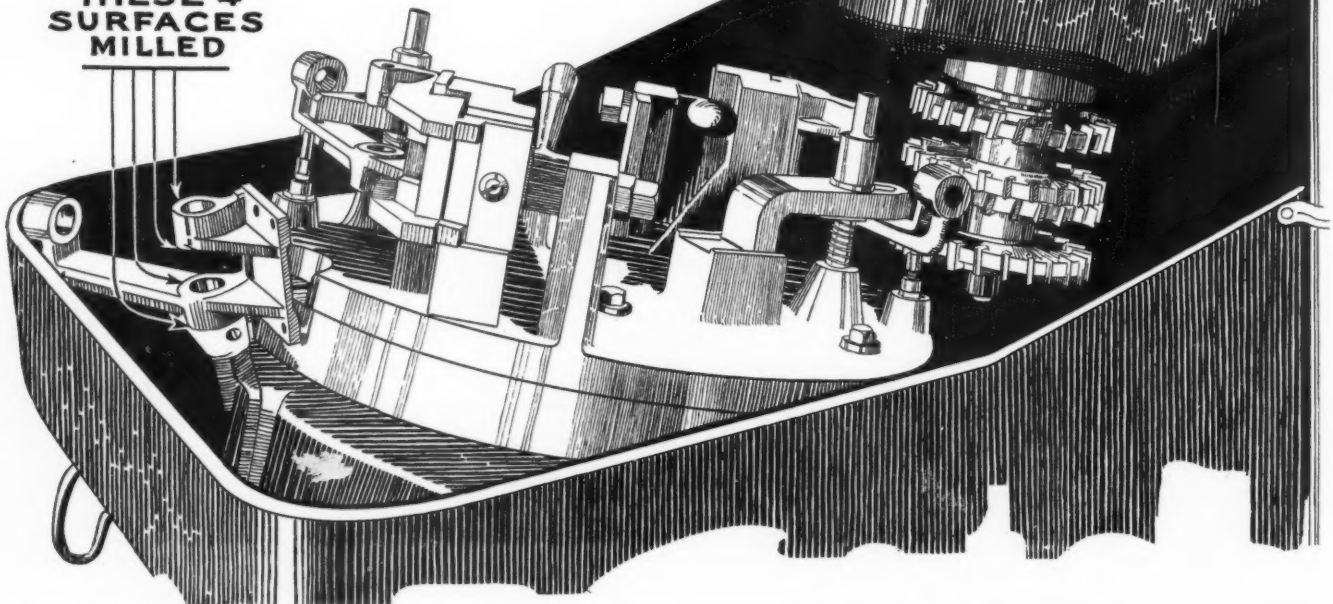
Equally as impressive production figures on job after job have proved this machine to be a production wonder. On any job that can be handled on the Ohio Tilted Rotary production time is cut from minutes to seconds per piece. INVESTIGATE!

OESTERLEIN MACHINE CO.
CINCINNATI, OHIO

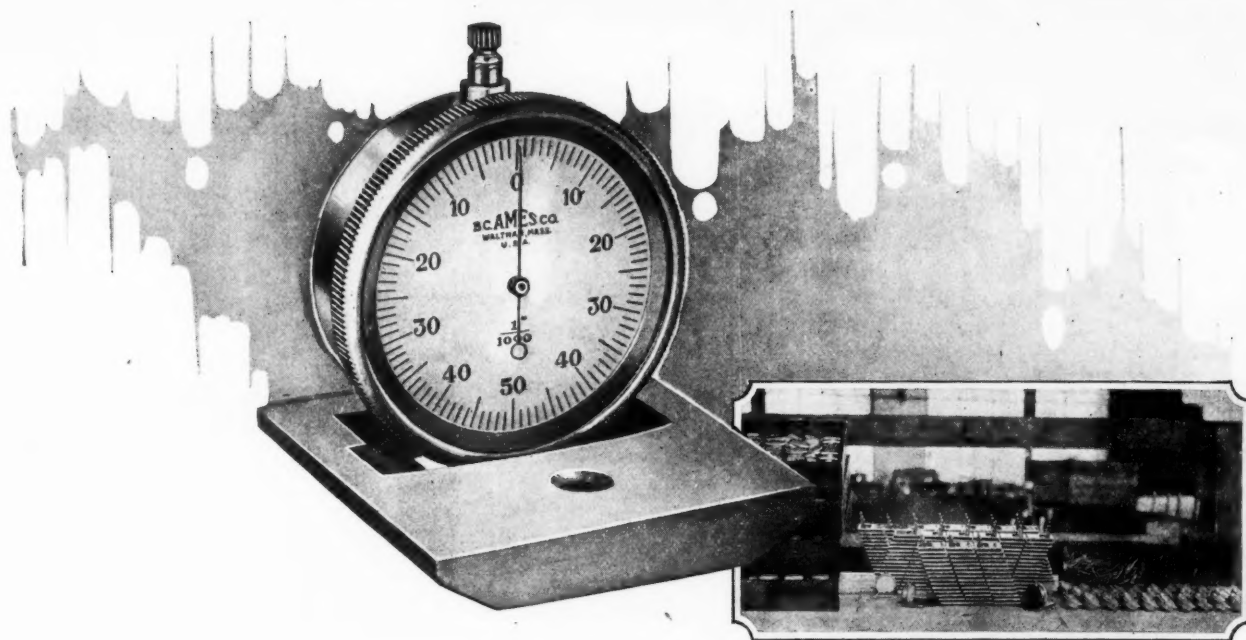
MILLERS **OHIO** GRINDERS

"TOOLS IN WHICH EVERY OUNCE WORKS"

**THESE 4
SURFACES
MILLED**



**OHIO TILTED ROTARY
MILLING MACHINE**



250 Ames Dial Cylinder Gauges go to Cadillac to Save Nine-tenths of the Cylinder Gauging Time *You Get the Reading at a Glance*

AT CADILLAC, Ames dial gauges are employed as regular equipment to assure absolutely accurate production. The above shipment of 250 dial cylinder gauges, which recently went to Cadillac for use in their factory and service stations, shows what these people think of Ames dial gauges.

Not only do they gauge a cylinder in one-tenth the usual time, but their extreme accuracy and ease of application make them of unusual value in any shop where cylinder work is done.

No matter what size engine you build, if the cylinder bore is too large or small, out of round, or not straight, this gauge will instantly show the error to a quarter thousandth of an inch.

Easy to Use

In testing a cylinder bore during grinding, after the wheel head has been withdrawn, it does not have to be moved from line of work, as the gauge is small enough to slip in between wheel and work, thus leaving the wheel setting undisturbed.

The cylinder gauge is but one of the hundreds of applications of Ames dial gauges. They are standard equipment on close limit work in many of America's finest automotive plants.

Our booklet, "Dial Gauges," tells our story. It deals with gauges that will fit perfectly into your most difficult measuring problems. It stands for increased accuracy of product.



Send **TODAY** for our catalog, "Dial Gauges." A reading will prove just what Ames Dial Gauges will mean in greater accuracy and speedier production in your shop. Price quotations come with each catalog.

B. C. AMES COMPANY
WALTHAM MASSACHUSETTS

BC. AMES CO.
WALTHAM MASS. U.S.A.



Valves & Bolts

Inlet and Exhaust Valves Hardened and Ground Bolts

SPECIALIZED SERVICE—AND WHAT IT MEANS TO YOU

When you want Poppet Valves, Hardened and Ground Bolts in small quantities where do you go?

To the Quantity Producer—to the plant equipped to handle large orders?

If you do—you know the inevitable result—your order for five or ten thousand parts is lost in the shuffle.

We specialize on orders within the ten thousand limit—have developed our entire equipment to handle that kind of work.

Consequently our service is impressive evidence of our methods.

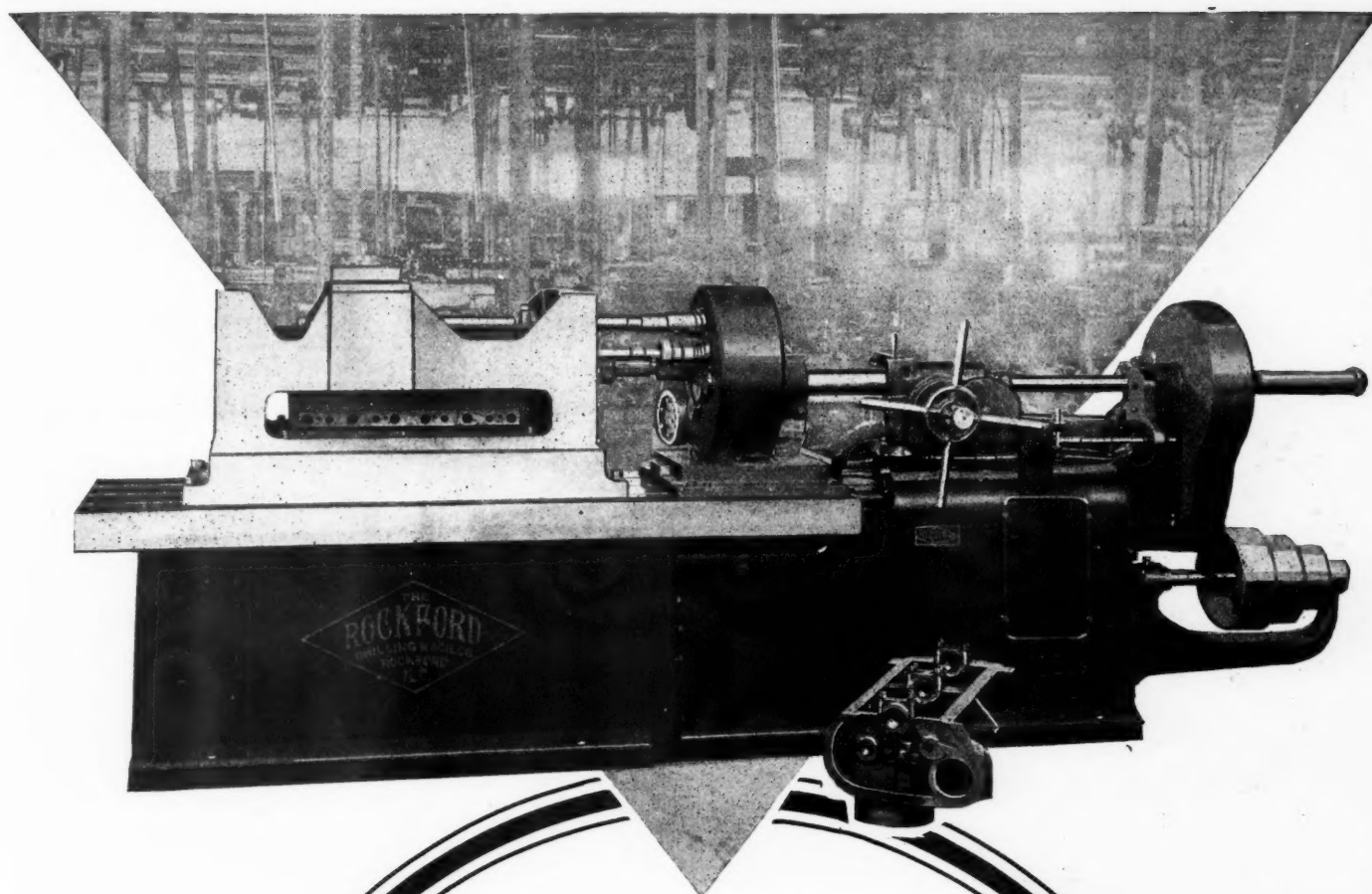
We would like to quote you on your next requirements.

Send us samples or blue prints today.

THE FORD-CLARK COMPANY

The Big Plant Specializing On Small Orders

3125 PERKINS AVE., CLEVELAND, OHIO.



Rockford Boring Machines Speed Up Production

Never before in the history of the Automotive Industry have the possibilities been so great, or the schedules for production so large, as this year.

Passenger cars and trucks are *bought* these days—not *sold*. There is still a slight resistance in the tractor field, but it is rapidly disappearing in the face of the demonstrated practicability of Power Farming Equipment.

Yet the manufacturers are handicapped in their production through lack of labor. The labor available is so high priced, that it has become necessary to install repetition machinery to maintain schedules.

Rockford Heavy Duty Horizontal Boring and Drilling Machines for crank case, transmission case and rear axle work for automobiles are daily turning out a large quota of work in the largest plants in the country.

They lend themselves readily to application of multiple drive heads for boring from two to ten holes at a time. Two or more pieces can be operated on at one time conserving floor space and operators.

Built to customers' specifications as to spindle height above table, length of table and distance between spindle ends.

Investigate the Rockford line. Send for descriptive literature. It will show you the way out of your production difficulties.

ROCKFORD DRILLING MACHINE CO.

Rockford, Illinois

Canadian Agents: Rudel-Belnap Machinery Co., Montreal and Toronto

E. L. Essley Machinery Co., 552 Washington Blvd., Chicago, Ill.; Marshall & Huschart Machinery Co., 334 North Capitol Ave., Indianapolis, Ind.; Marshall & Huschart Machinery Co., 905 Chemical Bldg., St. Louis, Mo.; Henry Prentiss & Co., Inc., Singer Bldg., New York City, N. Y.; Henry Prentiss & Co., Inc., 724 Prescott Ave., Scranton, Pa.; Herberts Machinery & Supply Co., 405 E. Third St., Los Angeles, Calif.; Henry Prentiss & Co., Inc., 607 D. S. Morgan Bldg., Buffalo, N. Y.; Henry Prentiss & Co., Inc., 49 Federal St., Boston, Mass.;

Henry Prentiss & Co., Inc., 520 University Block, Syracuse, N. Y.; Henry Prentiss & Co., Inc., 315 E. & B. Bldg., Rochester, N. Y.; Somers, Fidler & Todd Co., 323 Water St., Pittsburgh, Pa.; Monarch Machinery Co., 300 Third St., Philadelphia, Pa.; Strong, Carlisle & Hammond Co., 270 Jefferson Ave., Detroit, Mich.; Strong, Carlisle & Hammond Co., 326 Frankfort Ave., N. W., Cleveland; Herberts Machinery Co., 168 Second St., San Francisco, Calif.
Foreign Representative: Burton, Griffiths & Co., London.



“THE Boss thought any old oil would go — but he soon learned better.

“His trade likes this SUPREME AUTO OIL—It leaves less carbon, and your engine runs sweetly—no bearing knocks.”

Dealers and Motorists are satisfied with

Supreme Auto Oil

Its less carbon feature, combined with viscosity and wearing qualities possessed by the Light, Medium, Heavy and Extra Heavy, has popularized it with more than a million motorists.

It is free from paraffine which forms a sticky gum on piston heads to which free carbon readily adheres, being hardened by the excessive heat.

Write us if your dealer doesn't have it.

Look for the Sign of the Orange Disc

GULF REFINING CO.

There is More Power in THAT GOOD GULF GASOLINE and SUPREME AUTO OIL

"A time-proved quality that extends to every part of every Rivett product and is reflected in the work they do."



"A never-ending service in promptly supplying repair parts and operating assistance when needed insures the profitable performance of Rivett Products from the day they enter your plant."

Why Does the Rivett Make Good on Automotive Work?

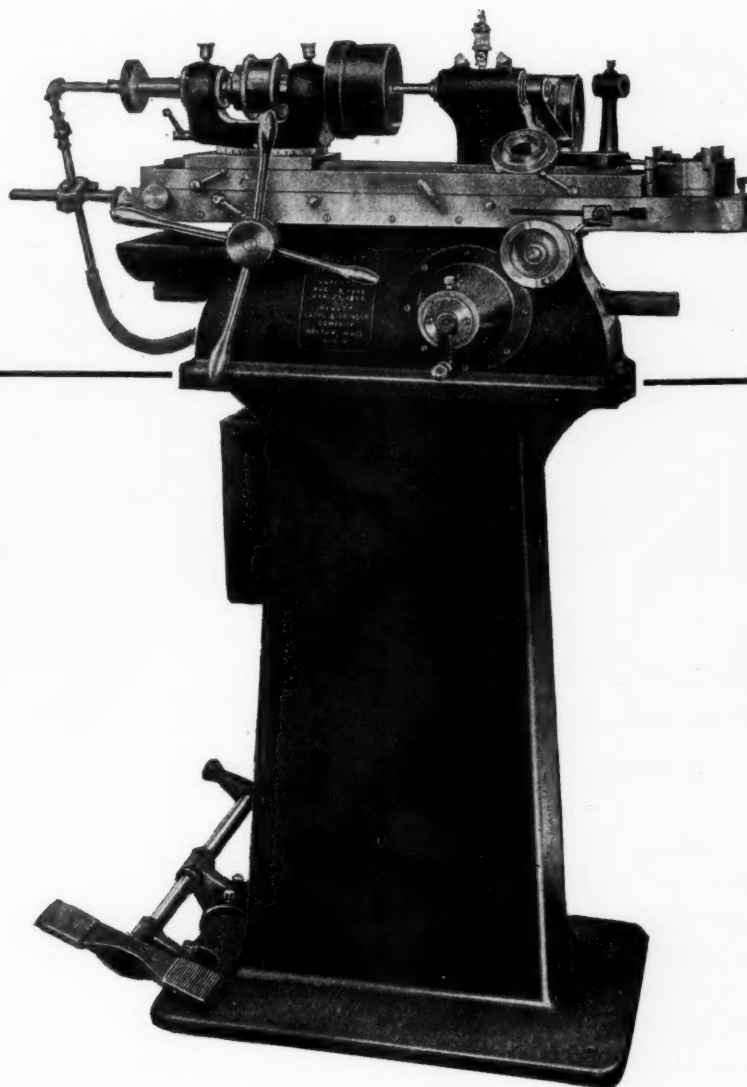
Because of its adaptability to the needs of this field

To meet the present-day demand for quality of product, together with quantity and low-cost production, the automotive manufacturer insists that his machine tool equipment be accurate, fast and easy to handle. That's why so many manufacturers put internal grinding up to 2" in diameter on a

RIVETT No. 103 INTERNAL GRINDER

Full automatic, this super-accurate machine handles volume production in a way that counts big on production and cost sheets.

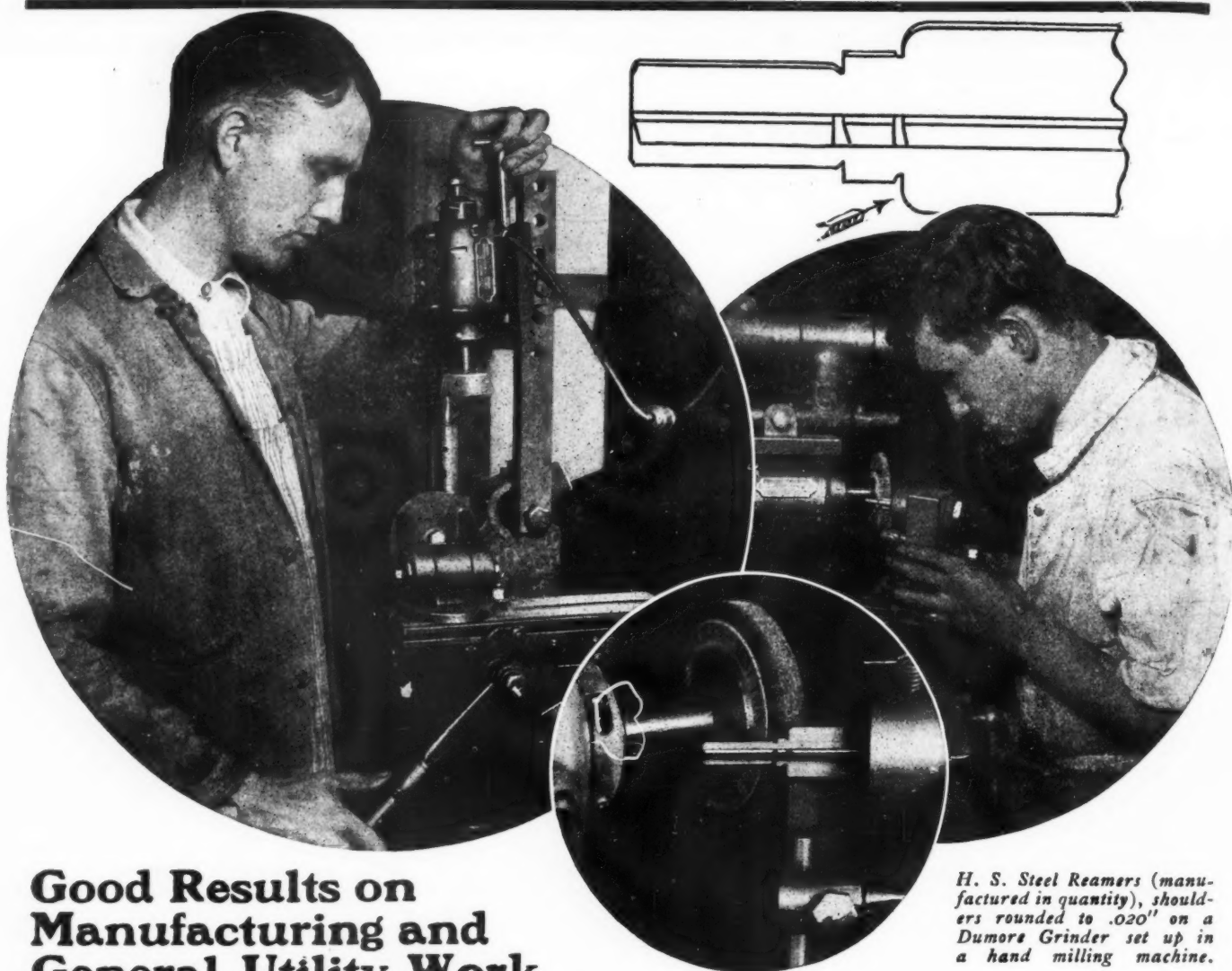
Let us tell you about this machine in detail. Write TODAY—NOW.



SPECIFICATIONS

Automatic Range $\frac{1}{64}$ " to 2" dia.
Automatic Table Travel 2"
Hand Table Travel 11"
Swing of Work Head 8"
Automatic or Hand Cross Feed

RIVETT LATHE *and* GRINDER COMPANY
BRIGHTON DISTRICT of BOSTON, MASSACHUSETTS
"MAKERS OF THE WORLD-KNOWN RIVETT PRECISION LATHE"



Good Results on Manufacturing and General Utility Work

Dumore Grinders are never idle at the Bilton Machine Tool Company, (Bridgeport, Conn.) plant. Their convenience and adaptability make them as useful for special jobs as on the standardized operations of routine work. Dependably accurate and almost fool-proof, they rarely need repairs and can be counted on to do excellent work of wide variety

at extremely low operating costs.

The large photograph shows the Dumore Grinder used for sharpening the end teeth on milling cutters—the others illustrate a unique set up of both grinder and work on a manufacturing job.

Ask us about Dumore Grinders and the shops that use them. You will be amazed at their wide application and general popularity on all classes of work.

H. S. Steel Reamers (manufactured in quantity), shoulders rounded to .020" on a Dumore Grinder set up in a hand milling machine.

WISCONSIN ELECTRIC COMPANY
6924 Sixteenth Street **RACINE, WISCONSIN**

DUMORE HIGH SPEED GRINDERS

90% of all Troubles are Bearing Troubles

From careful observation it has been determined that fully 90% of the motor trouble originates in the bearings.

The "high spot" areas in the imperfect, hand-scraped bearing carry the load and it is here, through faulty lubrication, that metal to metal contact comes, starting the "pick up."

A "pick up" of a thousandth of an inch makes a high riding point that causes a hot bearing. Unless this "pick up" can be immediately cut away and the bearing freed, serious consequences result.

A pinch of **TIMESAVER** Bearing Abrasive Compound mixed in the lubricating oil will almost instantly grind the bearing free and end the trouble, but—

If the bearing had originally been ground in with **TIMESAVER** Compound it would have had a uniform surface for the film of oil, insuring perfect lubrication. Hence there would have been no metal to metal contact and no "pick up."

Because **TIMESAVER** Compound will not cut iron or steel and because

it is soluble in oil, which causes it to lose all abrasive power after a few minutes use, it is absolutely safe, even in the hands of the most inexperienced.

TIMESAVER Compound is unique among abrasives. There is nothing else in the world like it. It will produce perfect surfaces in any size or type of babbitt, brass or bronze bearings in about a quarter the time taken in hand-scraping.

Thousands of users in the marine, automotive and mechanical fields have already discarded other methods for the **TIMESAVER** way of fitting bearings. If you are not yet familiar with the marvelous results being attained, mail the attached coupon with \$1.50 and a trial can will be sent you. Your money will be refunded if you are not entirely satisfied.

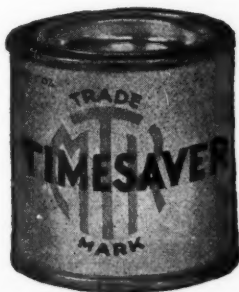
Our consulting engineer, Mr. William D. Jones, is at your service to assist with production problems incident to the adoption of **TIMESAVER**.

M. T. K. SALES CORPORATION, 296 Andrews St., Rochester, N. Y.

International Distributors Timesaver Bearing Abrasive
Manufacturers, M. T. K. Products Company, Seattle, Wash.

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Timesaver Sales Corp., 370 W. 51st St.,
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Commerce Bldg., Chicago, Ill.
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USE THIS COUPON

M. T. K. Sales Corporation,
296 Andrews St., Rochester, N. Y.

Enclosed \$1.50 for ounce can of
Timesaver Compound with directions.
Money back if not satisfactory.

Name

Street

City

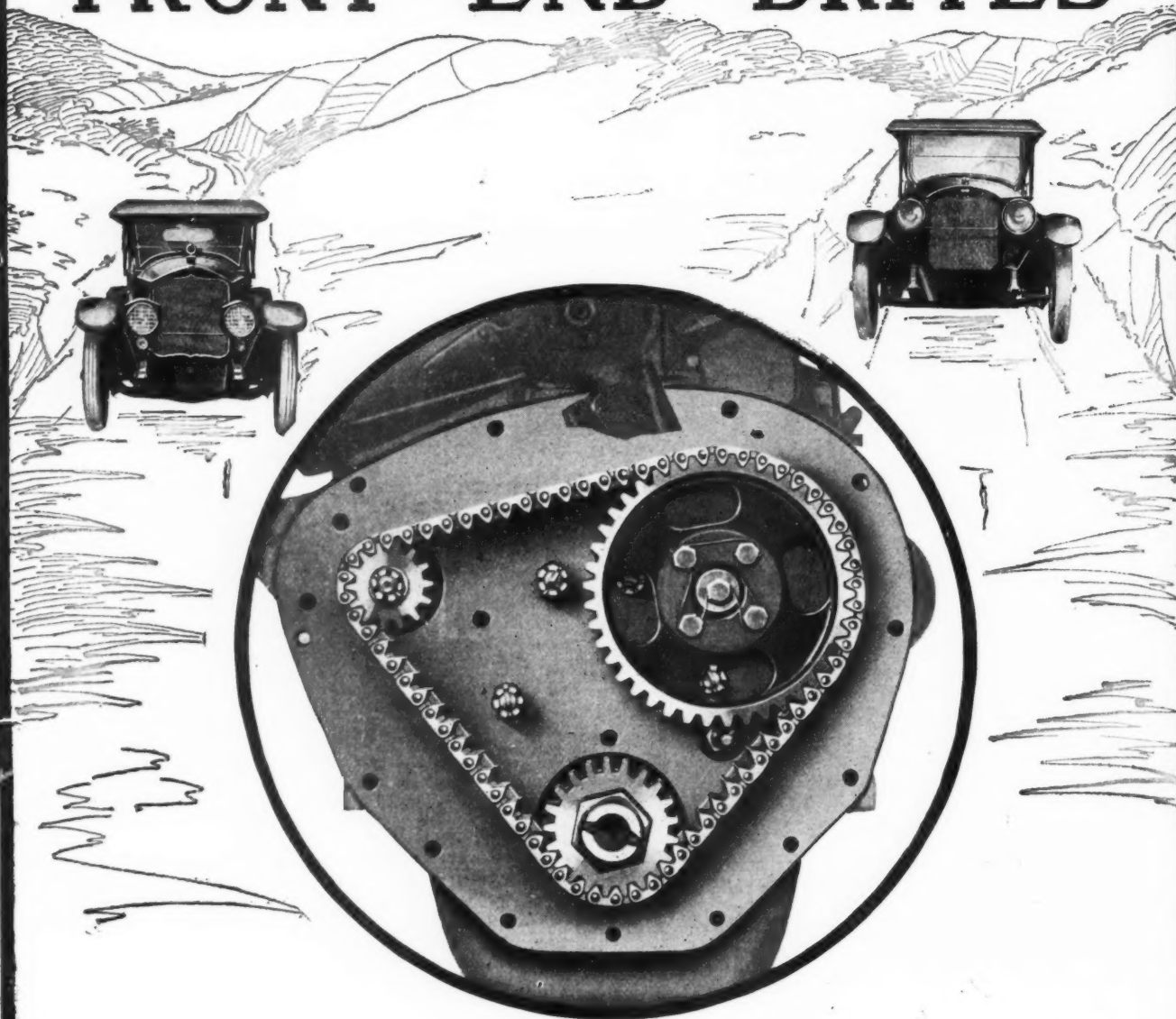
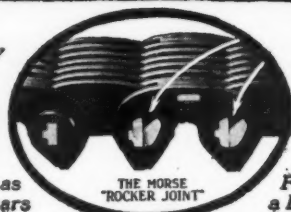
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The Drive of Efficiency
MORSE
Positive as Gears

The Drive of Durability
CHAINS
Flexible as a Belt

Longer Life

FRONT END DRIVES



We take great pleasure in announcing that the new Studebaker is equipped with the Morse front end drive.

Make your product better by joining the ranks of the famous car makers who use the Morse front end drive.

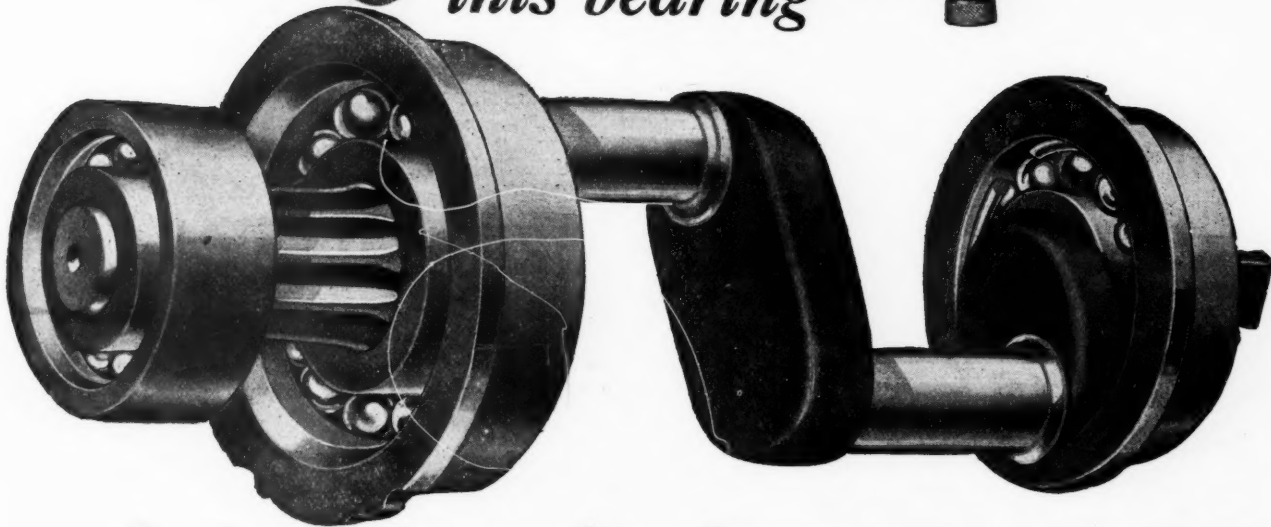
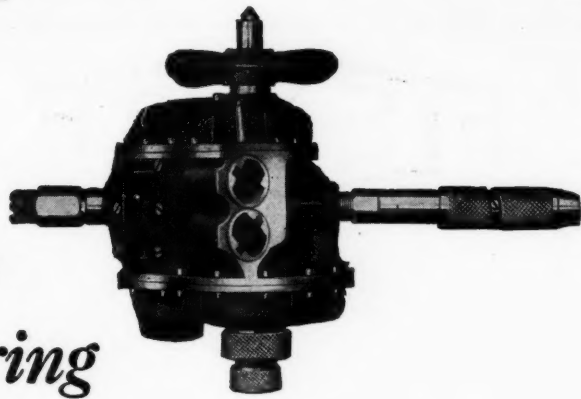
MORSE CHAIN CO.

*Largest Manufacturers of
silent chains in the world*

Ithaca, N. Y.

Detroit Sales and Engineering Office: 1003 Woodward Avenue

*You can
eliminate
this bearing*



—but you can't eliminate its job

THE job of the center annular ball bearing in Little Giant Air Drills is to support the crankshaft on *both* sides of the main driving gear. Incidentally, it saves air and reduces upkeep costs.

And eliminated crankshaft troubles mean decreased stoppage for repairs—more work units per drill.

Three-point ball-bearing suspension is a *Little Giant* feature. It is one of many features that make Little Giants *your* logical standard air drill. Every Little Giant feature has an *essential* purpose.

Requisition a trial Little Giant from large stocks now carried at the Company Branches listed below. And ask for new bulletin.

Chicago Pneumatic Tool Company

Chicago Pneumatic Building . 6 East 44th Street . New York

Sales and Service Branches all over the World

BRIMMIDHAM • CHICAGO • DETROIT • EL PASO • LOS ANGELES • MINNEAPOLIS • PHILADELPHIA • RICHMOND • SEATTLE • BARCELONA • BRUSSELS • CHRISTIANIA • HONOLULU • LONDON • MONTREAL • ST. LOUIS • TUCSON • BOMBAY • CADIZ • BUENOS AIRES • FRANKFURT • HAVANA • LIBON • MADRID • MILAN • OSAKA • PARIS • TOKYO • VANCOUVER • WINDHOLE

P-63

BOYER PNEUMATIC HAMMERS • LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS • VACUUM PUMPS • PNEUMATIC HOISTS,
GIANT OIL AND GAS ENGINES • ROCK DRILLS • COAL DRILLS

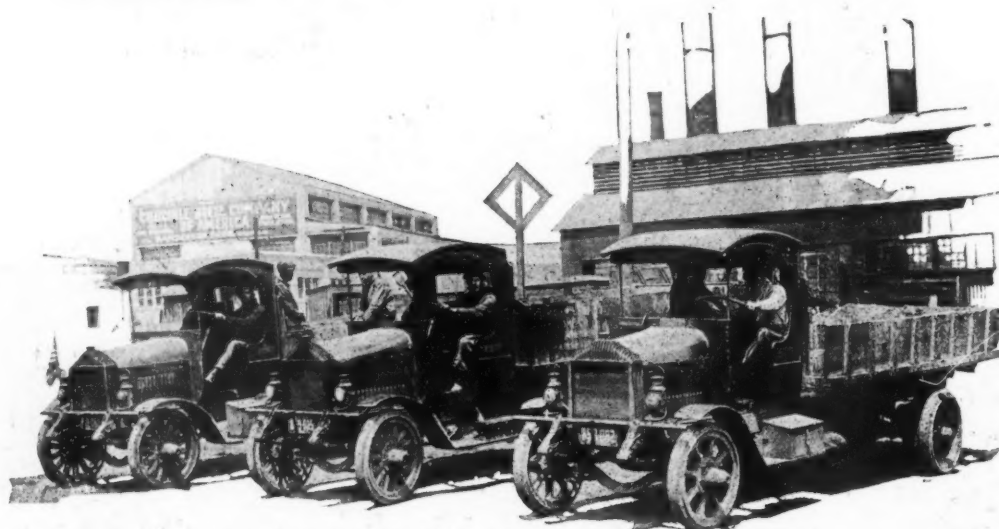
LITTLE

Air

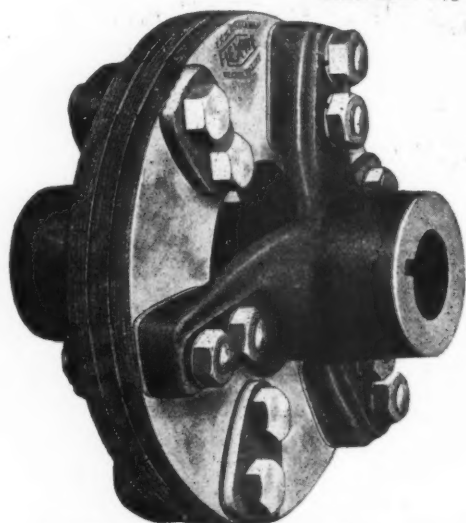


GIANT

Drills

FLEXITE**Propeller Shafts
and Universal Joints**

SANFORD 3 1/2-Ton Trucks (Model W-35). FLEXITE Equipped.



Assembly of FLEXITE Patented Heavy Duty Universal Joint.

Success Proved by Service

Flexite Patented Heavy Duty Universal Joints are working in steady, unspectacular fashion in Sanford Motor Trucks operated by the largest and best-known industrial enterprises in the United States, as well as for hundreds of small firms and individuals.

The record of the success of FLEXITE in the products of the leading truck manufacturers proves the correctness of FLEXITE design and the constant vigilance in research and manufacturing by FLEXITE Engineers.

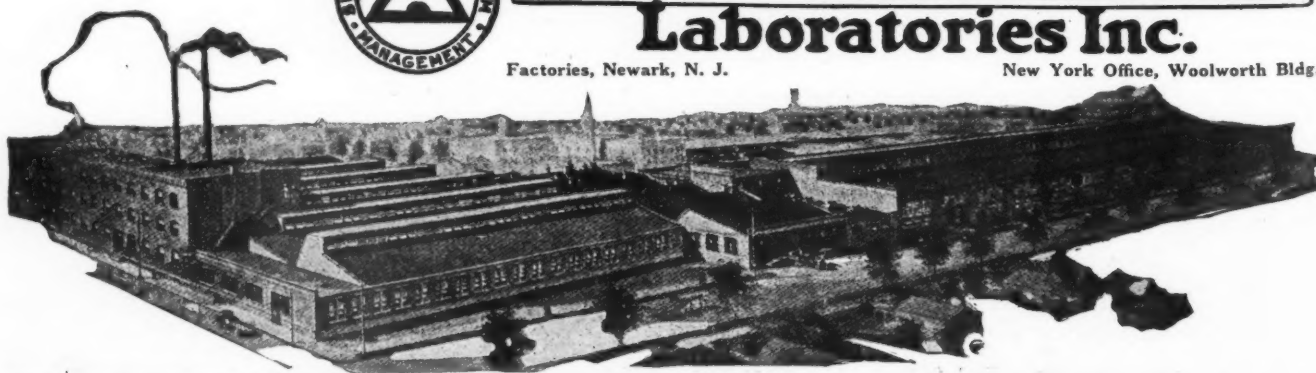
Send for Bulletin.

Makers of Flexite Patented Heavy Duty and Medium Duty Universal Joints and Propeller Shafts, and Flexite Standard Magneto and Generator Couplings. Flexite Discs for All Purposes.

**Slocum Avram & Slocum
Laboratories Inc.**

Factories, Newark, N. J.

New York Office, Woolworth Bldg.

Direct all
Communications to:**G. A. UNGAR, General****FLEXITE**Sales Agent, Room 4001 Woolworth Bldg.
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No. 5 Little David
Drill Boring Body
Frames.



More and more automobile manufacturers and part makers are adopting or extending the use of LITTLE DAVID PNEUMATIC TOOLS in their shops, because of their simplicity, sturdiness and power.

Write our nearest branch for particulars.

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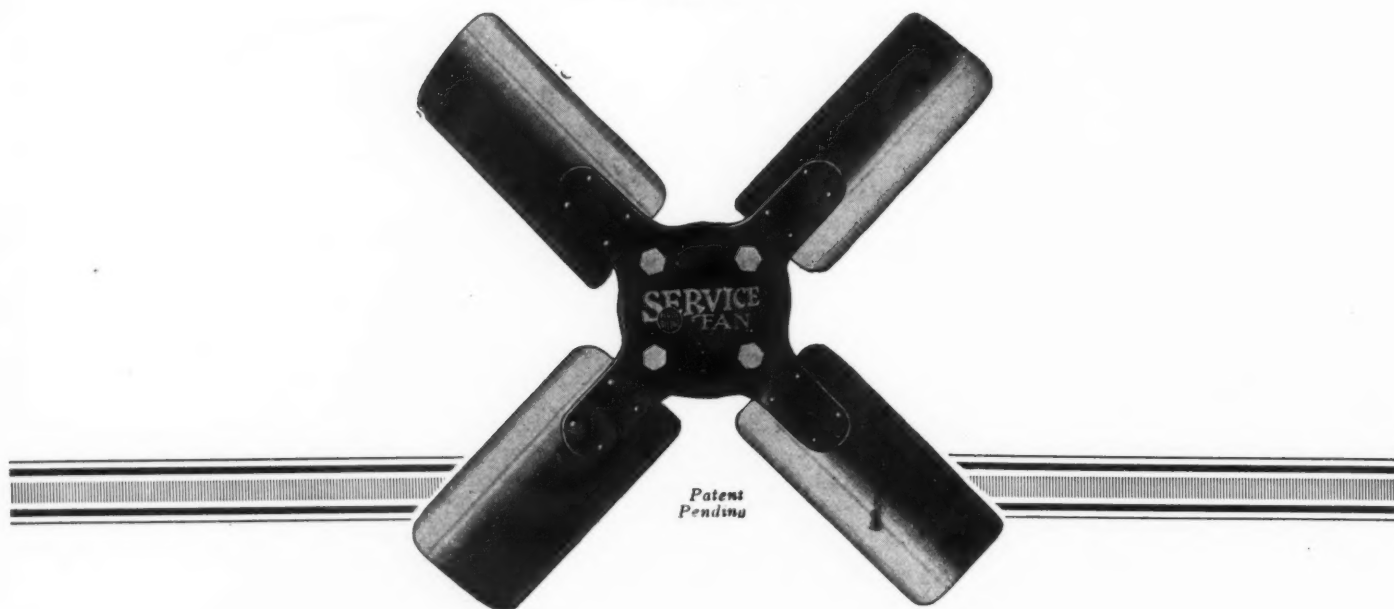
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Grinders, Pneumatic
Hoists, Pneumatic
Hose, Pneumatic
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Pumps, Vacuum
Receivers, Air
Reheaters, Air
Riveting Hammers, Pneumatic
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Ingersoll-Rand



SERVICE FAN

FLOOD
OILING

Offers the utmost in efficiency
and durability.

Fans for all standard and spe-
cial installations.

SERVICE PRODUCTS CORP.

INDIANAPOLIS

INDIANA



EXCLUSIVE INTERNAL GEAR ADVANTAGES

Group of Fellows Gear Shapers at Work in the Plant of the Russel Motor Axle Co., Detroit, Mich.

The following are a few of the many exclusive advantages of the internal gear as a final rear axle drive for commercial cars, trucks, and tractors.

1. Ease and simplicity of manufacture.
2. Efficient under all conditions of road and service.
3. Ease of adjustment and repair.
4. Serviceability and long life.

The internal gear is a simple proposition from the standpoint of manufacture. It can be cut on the Fellows Gear Shaper with the same ease and dispatch as an ordinary external spur gear. No attachments of any description are necessary. The same Gear Shaper Cutter is used in cutting the internal gear as that used for cutting its mating pinion.

The internal gear forms its own housing, protecting it from dust and dirt. It requires little if any attention, and is always in alignment. It is efficient at all speeds, does not "lock" and is not affected by inequalities in road surface.

Any garage man can adjust or repair an internal gear, because minute adjustments are unnecessary.

The internal gear does not become inefficient, even after severe service, which is true of both the worm and chain drives. It, therefore, has a much longer life.

If you are interested in this subject, why not get in touch with our Engineering Department and have the advantages of the internal gear explained to you in detail? This service is yours for the asking.

The Fellows Gear Shaper Co.

Springfield, Vermont, U. S. A.

Foreign Agents: Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama,

Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert, Ltd., Calcutta, India.



The Cowan Trucking System Speeds Production In The Pierce-Arrow Automobile Plant

**THE COWAN
TRANSVEYOR**

The Cowan System plays an important part in building Pierce-Arrow cars and trucks at the Buffalo, N. Y., plant. The raw material is loaded onto skids or platforms and wheeled to the various finishing machines until the complete part is made.

The Cowan Transveyor, and the platforms, which are built at the plant, does away with all unnecessary loading and reloading.

The Pierce-Arrow Company have found out that the Cowan Transveyor is something more than an improved trucking device: it is a modern system that has completely revolutionized the loading, unloading and transporting of machine parts in their factory.

Cowan Transveyors are made entirely of high grade steel, except the wheels and the brass hydraulic ram cylinder. Made in 18 sizes and styles. A five year written guarantee against defective material and defective workmanship goes with each one.

There is a Cowan representative in your territory that gives personal service. Let him look over your plant and tell you how to cut down the pay-roll and speed up production.

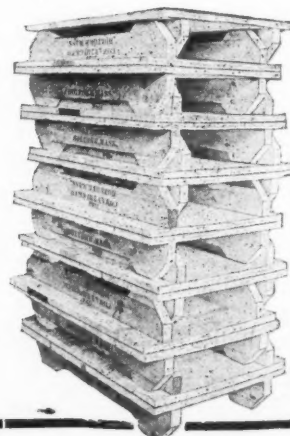
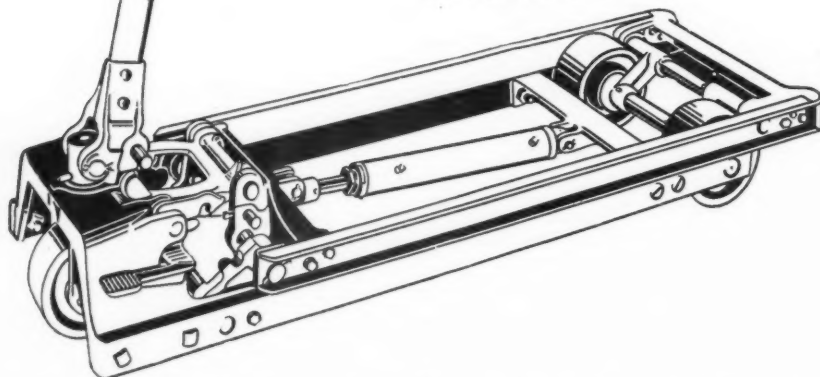
Send to us for "How to Apply the Transveyor to Your Business"

COWAN TRUCK COMPANY

Originators of the Lift Truck System

5 Water Street

Holyoke, Mass.



COWAN TRANSVEYOR

The Lift Truck That Revolutionized Factory Transportation

CAN YOU PILE 15
TRUCKS LIKE THIS?

Achievement in Design



No Filling Slots

Among other features of superiority in design, the Schatz Universal Annular Ball Bearing has no filling slots. There is no opening of any kind in the races where the balls may be jammed or ruptured.

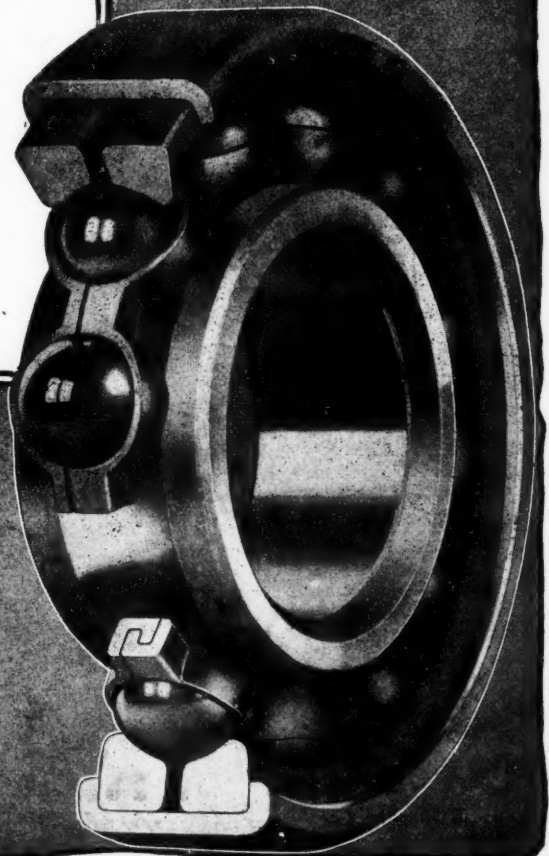
Increased strength and efficiency—300% to 400% greater thrust capacity than any other annular ball bearing—materials and workmanship unexcelled—these are vital considerations in a good bearing.

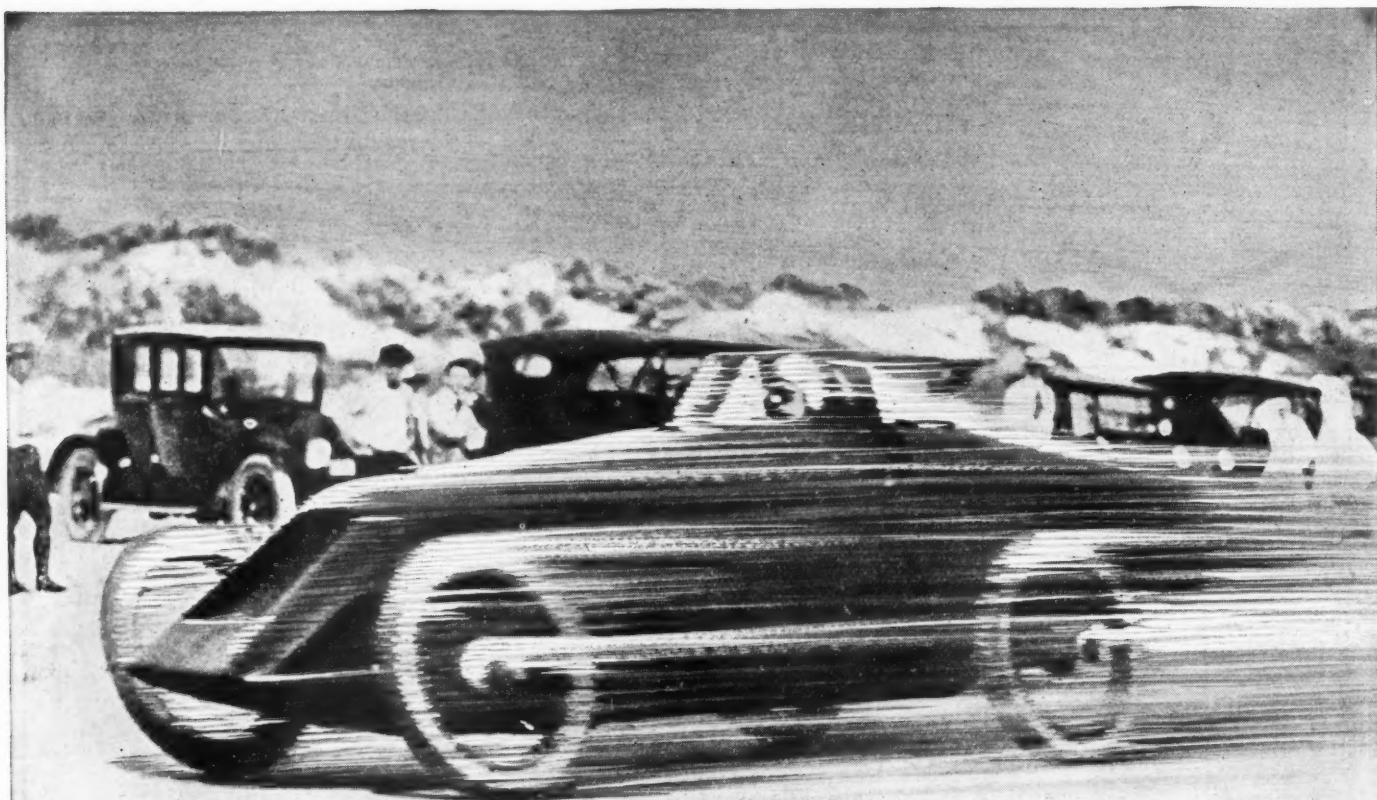
Specify the bearing with a margin of safety—Schatz Universal.

THE FEDERAL BEARINGS CO., INC.,
Poughkeepsie, N. Y.

Great Britain: 37 Sheen Road,
Richmond, London

Schatz
UNIVERSAL
Annular
BALL BEARING





TRAVELLING at the rate of 156.04 miles per hour at Daytona Beach, Tommy Milton, in a Duesenberg car, broke six world's speed records and established a new one.

This speed of almost three miles per minute was faster than any man has ever travelled on earth. The Duesenberg Twin Eight was equipped with Delco ignition.

It is not unusual for Delco to be on record breaking trips—Major Schroeder's altitude climb, the NC-4 trans-Atlantic flight, the Hudson Super-Six trans-continental run, and the Essex fifty hour grind—all are world's records.

Every user of Delco equipment will appreciate Tommy Milton's compliment when he said, "Delco ignition worked perfectly at all times."

Delco claims no credit for making these remarkable speed records but believes that the hundreds of thousands owning Delco-equipped cars will feel complimented to know that the ignition they use every day is also breaking world's records.

*New World's Records Officially
Accepted by the American
Automobile Association*

| | |
|---------------------|------------------------------------|
| ½ mile . . . | :11.57 sec., 155.57 miles per hour |
| 1 kilometer . . . | :14.40 sec., 155.34 miles per hour |
| 1 mile . . . | :23.07 sec., 156.04 miles per hour |
| 2 miles . . . | :46.24 sec., 155.70 miles per hour |
| 3 miles, 1 min. . . | :12.18 sec., 149.62 miles per hour |
| 4 miles, 1 min. . . | :36.14 sec., 149.78 miles per hour |
| 5 miles, 2 min. . . | :00.04 sec., 149.95 miles per hour |

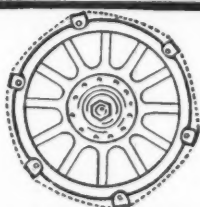
Delco



"Ask the Man Who Owns One!"

The
Packard

IS EQUIPPED WITH
FIRESTONE QUICK
DETACHABLE DE-
MOUNTABLE RIMS



The ordinary rim supported by local wedges becomes battered into a more or less hexagonal shape after continuous service. This causes improper rim alignment. The wedges wear, causing squeaks and knocks.

"THE Packard is permanent. It occupies a secure place in the automotive world. Its engineering principles were not hit upon by chance. It is not subject to experimental changes."—Recent Packard Advertisement.

Packard and Quiet are synonymous. The Packard is equipped with Firestone Quick Detachable Demountable Rims.

The factor for quietness in Firestone Quick Detachable Demountable Rims is the triangular-shaped locking ring. When clamped in place, this feature holds the rim in positive contact with the wheel at every point on the felloe band, preventing rim slippage and eliminating squeaks.

Firestone Quick Detachable Demountable Rims of this same type are available for every size tire—from 32 x 3½ inch up to and including 40 x 10 inch. "Firestone" is stamped on every Rim.

The Firestone Steel Products Co.

Firestone Park, Akron, Ohio

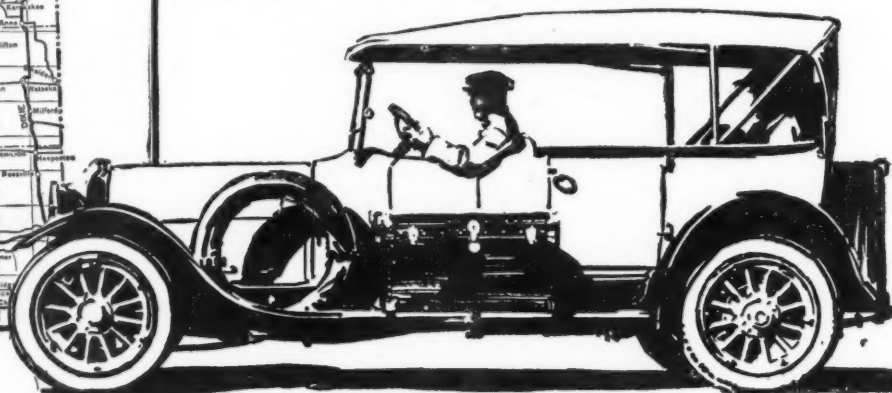
America's Quiet Cars are equipped with

Firestone

Quick Detachable
Demountable Rims



The Mileage of a car determines its Condition



BE fair to the motors intrusted to your care. Find out exactly what grade of oil is required by the *present condition of each motor*.

If a car has traveled over 5000 miles it probably needs a heavier oil than the one used when it was new.

If a car is greatly worn it probably needs a *still* heavier oil.

Be fair to each car from the beginning and remember that it is never too late to begin.

Learn the Law of Lubrication—consult the *Sinclair Recommendation Index*—and give your customers scientific lubrication.

The LAW of LUBRICATION

FOR EVERY MACHINE, of EVERY DEGREE of WEAR there is A SCIENTIFIC SINCLAIR OIL to SUIT its SPEED AND CONSERVE its POWER.

SINCLAIR REFINING COMPANY, CHICAGO

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Omaha
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Wichita

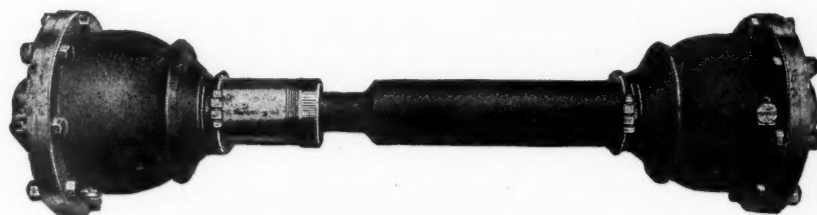
The Sign of

Sinclair Service

Spicer

UNIVERSAL JOINTS AND PROPELLER SHAFTS

Grease-tight, dust-proof, with all parts interchangeable, Spicer Universal Joints and Propeller Shafts have, since 1904, met with ever-widening engineering approval. Today over one hundred and twenty-five of the leading automobiles and trucks are Spicer equipped.



SPICER MFG. CORPORATION

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Sales Representatives:

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A. H. Coates, 41 Spear Street, San Francisco, Cal.

Export: Benjamin Whittaker, Ltd., 21 State Street, New York, and
56 Ludgate Hill, London, E. C. 4

"The Motor That Made the Spad Possible"

These Advantages Helped Make a Better Airplane Engine for You

THE Wright-Hispano Aeronautical Engine is the American development of the famous French motor which was designed in 1914 to incorporate advantages not possessed by other engines at that time.

Further American development has brought about many important changes in the original design which has "carried on" still further the competitive advantages that have always been so characteristic of this great engine.

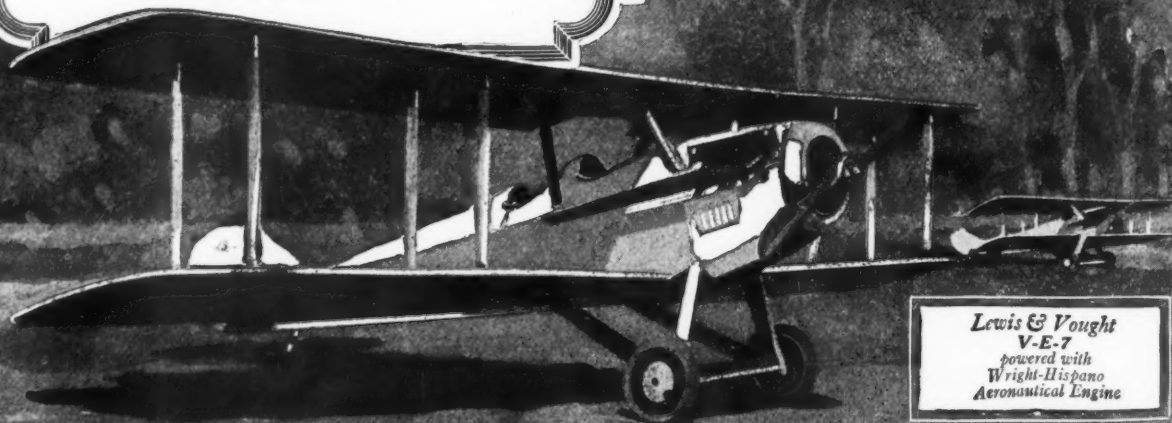
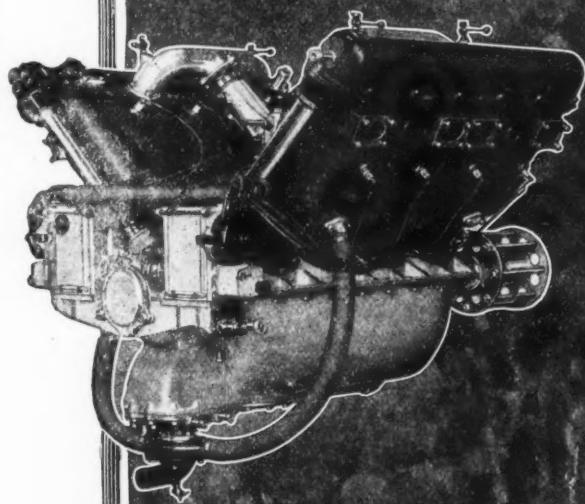
It is our purpose to make clear to the plane builder and owner in these pages the advantages possessed by the Wright-Hispano Engine in dependability, compactness, streamline, flexibility, accessibility, weight-to-horse power and reliability.

In no other way can this Organization so well acknowledge its obligation to the manufacturer and the flyer and its firm purpose to remain pre-eminent in the aircraft motor field.

*There are available for immediate delivery
180 H. P. (Model E) Engines to recognized
plane manufacturers and responsible owners.*

WRIGHT
Aeronautical Corporation
New Brunswick N.J.

*Member Manufacturers'
Aircraft Association*



*Lewis & Vought
V-E-7
powered with
Wright-Hispano
Aeronautical Engine*

WRIGHT-HISPANO
AERONAUTICAL ENGINE



Exhaustive Analytical Research

has enabled us to select materials which are particularly adapted for use in automotive construction

Quality is the paramount consideration in the VICTOR product and the better automotive vehicle is assembled with VICTOR screws.

VICTOR SCREW WORKS, INC.

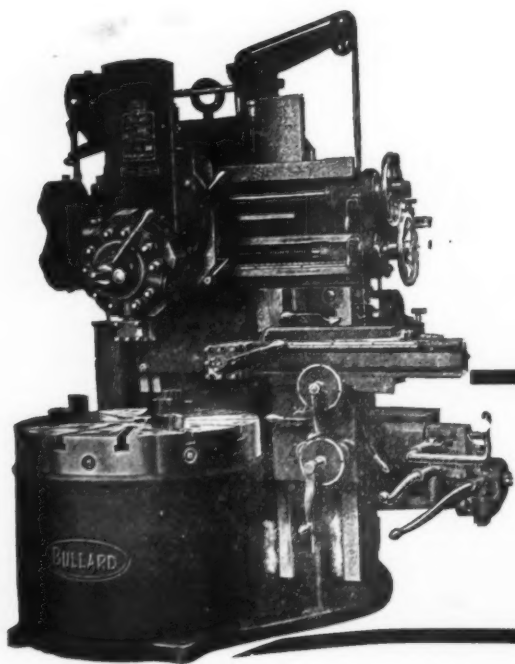
• DETROIT, MICHIGAN •

VERTICAL TURRET LATHE

*You Can't Get Men—
But*



To Bullardize is to obtain the greatest profit
per man, per machine, per minute, per inch
of floor space.



BULL YOUR PRO

MULT-AU-MATIC

MORE THAN A MACHINE
A MANUFACTURING METHOD

You Can Get Bullards

FILL the gap between the men you need and the men available with Bullards. Get those men you must have, right from the ranks of your present force. Bullardizing your production wherever possible will have just that effect on your present problem of increasing your production in the face of an ever-growing shortage of men—it not only insures a marked increase in parts produced but releases for other duties six, eight and often more men. And these men released for other work are already trained to your methods and your work.

The Bullard Mult-Au-Matic

Mult-Au-Matic Practice, as the method of producing parts on this machine is called in some shops that have Bullardized Production, is the logical way to handle that part of your output that requires a series of machining operations—castings, forgings and bar stock cut to lengths that require boring, facing, turning, threading, drilling, tapping, etc., singly or in combination.

More Than a Machine—A Manufacturing Method

The six stations will take the job from floor to finish in the time it takes to perform the longest single operation—and this time is cut to the "quick." One operator handles the loading and unloading, using the fraction of a minute between finished pieces to inspect. The result—one machine and one operator instead of six or more machines, six or more men and one to three inspectors—an equivalent output and at least an eighty per cent increase in production per day.

The Bullard Vertical Turret Lathe

In this machine we again find the answer to present-day production needs—several tools working simultaneously with the cutting time between cuts, cut to the "quick."

An advanced development of the engine lathe, the horizontal turret lathe and vertical turning and boring mill, all in one machine, the Vertical Turret Lathe, with its main and side heads carrying all the tools necessary for the job, represents the utmost in a production lathe for the manufacturer of cars, trucks, tractors, motors, wheels, and other parts.

Power operation of all parts and super-convenience in operation reduce the "time gaps" to a minimum, saves the operator's energy—it's easier to lay a piece down than to hang it up—and represents the acme of dependability, adaptability and productivity.

Shops That Have Bullardized Production

are getting sixty working seconds out of every minute, sixty working minutes out of every hour, have released many men—trained men too—for other duties and are getting every bit of production and profit out of every inch of floor space.

Bullard Engineering Service

is at your service, ready to study your particular problems on the machining of flywheels, pistons, gear blanks, sprockets, differential cases, motor parts, etc., ready to show you by figures and performance just what BULLARDIZING Your PRODUCT will mean. Send samples or blue prints with machining specifications.

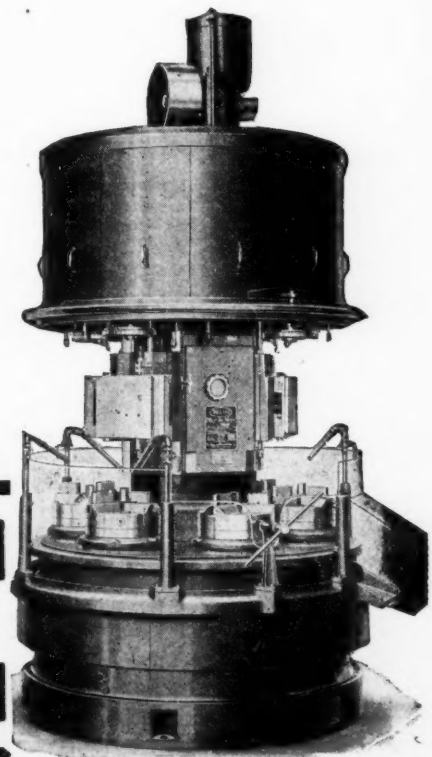
Literature on Request

The Bullard Machine Tool Company

Bridgeport,

Connecticut

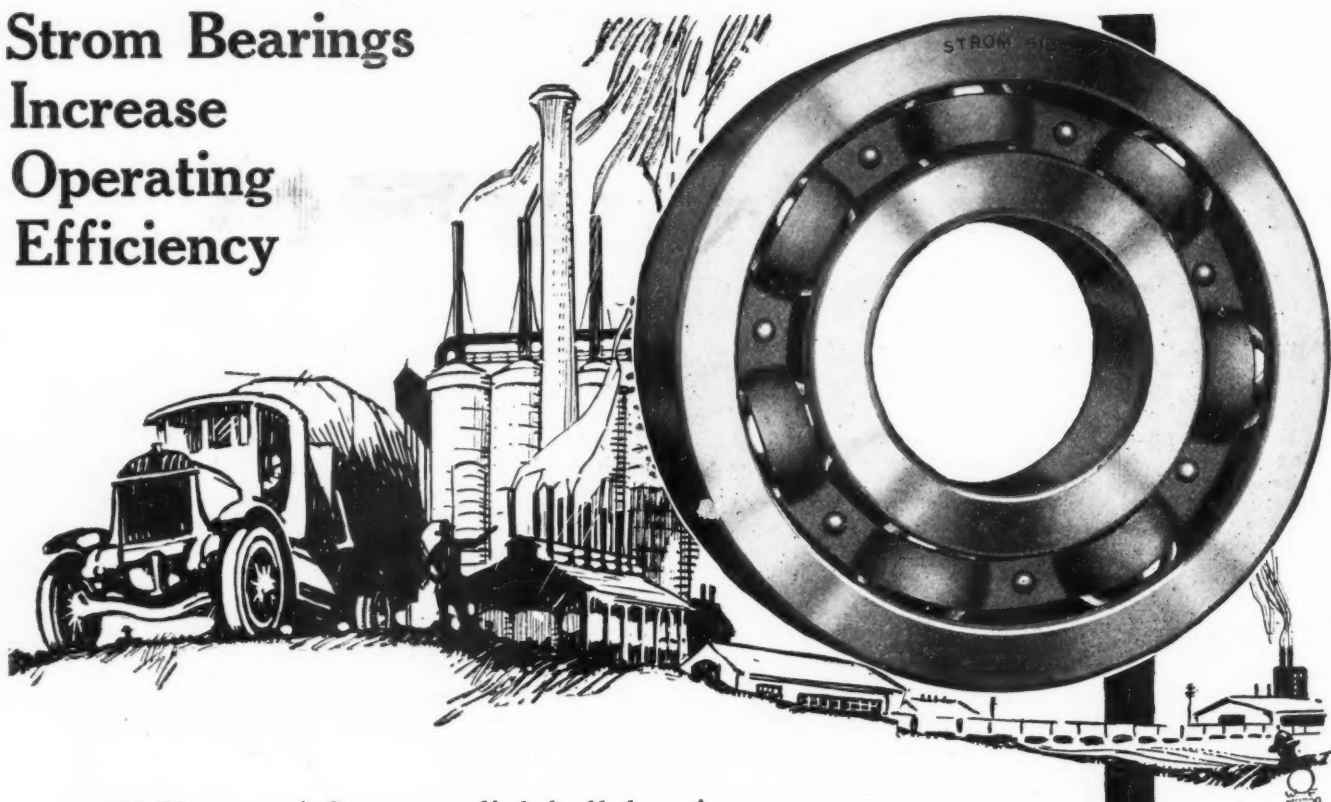
Builders of the Production-famous Mult-Au-Matic,
Vertical Turret Lathe and Maxi-Mill



BULLARDIZE

PRODUCTION

Strom Bearings Increase Operating Efficiency



BY use of Strom radial ball bearings rather than plain bearings in mounting motor truck crankshafts, the over-all length is reduced.

The bearings give increased efficiency, require less attention and are more accessible.

In solving any bearing problem you are at liberty to call upon Strom engineers.

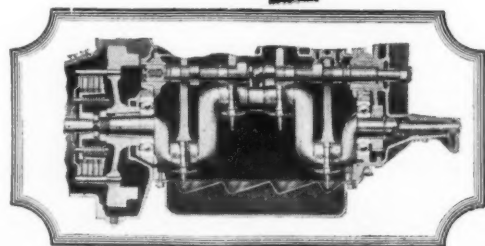
With their years of experience in installing these five bearings on all types of machinery, they are able to advise you as to the most scientific and economical type of bearing to use under any given conditions.

U. S. BALL BEARING MFG. CO.

(Conrad Patent Licensee)

4535 Palmer St.

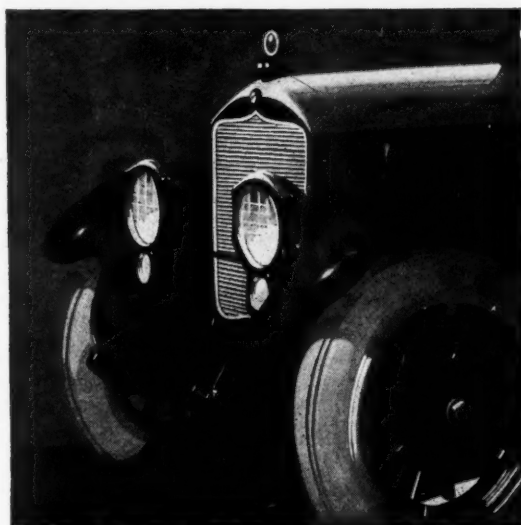
Chicago, Ill.



The radial bearings in this style of mounting are easily accessible.

Strom

BEARINGS



Master

ELECTRICAL PRIMER

on National Cars

That vibrant feel of power surging to life in any motor is a tonic that lifts auto riding from mere traveling to a distinct pleasure.

Drivers of the National car experience such a sensation. And this feeling of satisfaction is enhanced by the knowledge that no matter what the temperature or the grade of gasoline used the motor will respond instantly—even in frigid weather.

It is such thoughtfulness to detail that gives the National car distinction. As might be expected, it has Master Electrical Primer as standard equipment.

Master Primer Company

34 E. Larned Street

Detroit, Michigan

Standard Equipment on Quality Cars

Stewart

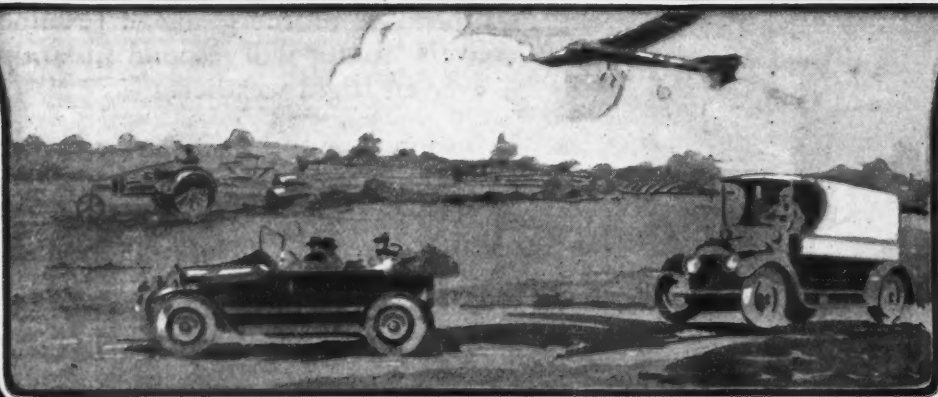
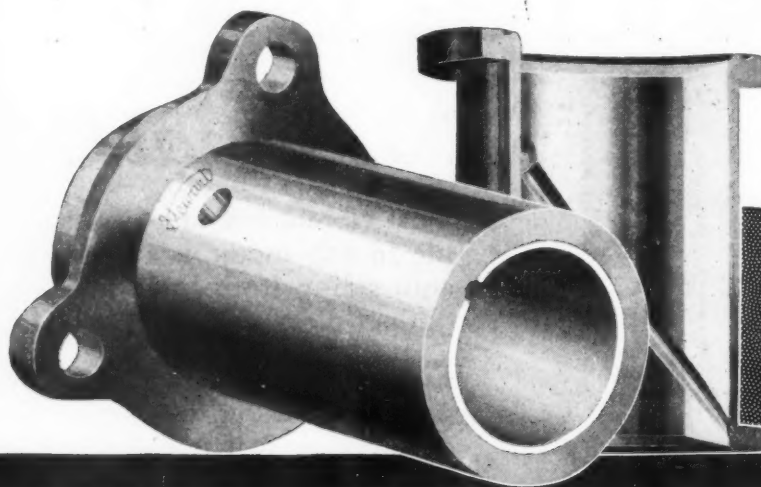
Solid Metal Rigidity With Babbit Softness

Wherever there is need for babbit lined bearings of unusual strength, rigidity and wearing quality, such requirements can easily be met by specifying the Stewart Bronze-Back Bearing.

A special process of metal cohesion, of uniting babbit with bronze, has successfully filled this demand.

In the mechanical construction of automobiles, tractors, trucks, aeroplanes, certain kinds of electrical and various other machines, the Stewart is the ideal bearing.

Stewart Manufacturing Corporation
4500 Fullerton Avenue CHICAGO





War Department

ORDNANCE SALVAGE BOARD

Surplus Property Sales

Opportunities for All

**Consumer — Retailer — Dealer — Jobber — Wholesaler
—Manufacturer**

The U. S. Ordnance Salvage Board is offering for sale through its several District Offices, listed below, large quantities and diversified classes of Materials and Equipment. The items detailed on the following pages are given merely as a suggestion of these various classifications. Read each page carefully. The items described are listed under the respective Districts by which they are held; they are not grouped into classifications.

These sales embrace items of value to almost every branch of modern industry.

Materials to be sold by NEGOTIATION

Sales methods are simple. All items, unless otherwise stated, are offered for sale by negotiation, and in lots sufficiently small to give all prospective purchasers an opportunity to buy.

IMPORTANT—Statements as to chemical analysis, specifications, conditions, or exact quantities are based on the best information available, but no guarantee on behalf of the Government can be given. Purchaser will be required to accept the material "as is" in its present condition. Inspection is therefore invited. Failure to inspect will not be considered a warrant for rejections or cancellation.

CERTIFIED CHECK, cashier's check, draft or legal tender for full amount must accompany shipping instructions. Checks to be made payable to the Treasurer of the United States.

ALL OR ANY PART of material listed may be bid on or sold.

UNIT—Submit bid in terms of unit listed, that is, quote price per piece, foot, gallon, 100 lbs., or gross ton, etc.

F. O. B. POINT—Quote price f. o. b. cars at plant where material is located or "on ground" if contractor buys material at his plant.

WEIGHTS—Government weights at point of shipment will govern.

DIFFERENCES IN WEIGHTS—If any difference between the weights indicated in this Bulletin and the actual weights should be discovered, the Government will refund or forward an invoice to the purchaser to cover any discrepancy and final settlement will be based on affidavits as to correct weights.

SHIPPING INSTRUCTIONS stating desired rate of delivery and name of delivering railroad in writing must reach the Committee interested within fifteen days from date award is made. The Government reserves the right to forward the entire shipment at a steady rate or as rapidly thereafter as shipping facilities will permit, unless special arrangements at time of purchase are made with the Committee to modify shipping procedure.

DEMURRAGE—The Government is not responsible for any demurrage, and any such charges accruing shall be paid by the purchaser.

Subject to Prior Sale

All items offered are subject to prior sale. Place your order promptly. Write or telegraph today.

Get the weekly DISTRICT BULLETINS

This advertisement covers only a small part of the materials and equipment offered for sale by the several ordnance District Salvage Boards. Each District Office issues a weekly bulletin which describes in details what that particular District has for sale. Write to the District Offices for their bulletins. The current copies will be mailed to you promptly.

If you desire to receive regularly the bulletins of any or all of the Districts, request that your name be placed on the mailing lists.

Watch for Succeeding Announcements

Ordnance District Salvage Boards:

| District | Address | Telephone Number |
|--------------|------------------------------------|------------------|
| BOSTON | 19 Portland St. | Army Wire |
| BALTIMORE | Columbia Ave. at B. & O. R. R. | |
| BRIDGEPORT | 945 Main St. | Noble 791 |
| CHICAGO | 74th & Ashland Ave. | Vincennes 3500 |
| CINCINNATI | 3rd & Vine Sts. | Main 3732 |
| TOLEDO | Storage Dept. No. 1 | |
| DETROIT | 35 Washington Blvd. | Cadillac 7680 |
| NEW YORK | 1107 Broadway | Army Wire |
| PHILADELPHIA | 1710 Market St. | Locust 5120 |
| PITTSBURGH | Neville Island, Coraopolis, Pa. | 30162 |
| ROCHESTER | 1048 University Ave. | Chase 4480 |
| ST. LOUIS | Missouri State Life Bldg. | Olive 6960 |
| MONTREAL | Notre Dame St. East, Montreal Can. | |
| OLD HICKORY | Jacksonville, Tenn. | |

See following pages for detailed descriptions of items offered

War Department

ORDNANCE SALVAGE BOARD

Surplus Property Sales



NEW YORK DISTRICT—

1107 Broadway
Army Wire

MILLERS

3—Becker Milling Machine Co. Milling Machines No. 1. Located at M. M. & M., Jersey City, N. J.

7—Garvin Machine Co. Profile Milling Machines, double spindle, No. 1. Location: U. S. A. S. B., Port Newark, N. J.

9—Pratt & Whitney Co. Profile Milling Machines, No. 12. Located at U. S. A. S. B., Port Newark, N. J.

4—Putnam Machine Co. Profile Milling Machines, No. 720. Located at U. S. A. S. B., Port Newark, N. J.

GRINDERS

9—Norton Grinding Co. Plain Cylindrical Grinders, 10" x 36" drive, line shaft and belt. Located at U. S. A. S. B., Port Newark, N. J.

RIFLING MACHINES

6—Sloan & Chase Mfg. Co. 36" Rifling Machines. Located at S. & C. M. Co., Newark, N. J.

The New York District has also to sell additional quantities of machine tools, motors, and building equipment, textiles and textile machinery, wrought iron pipe, metals, and chemicals.

The latest New York District Bulletin gives full details. Write for it.

PRESSES

5—Ferracute Machine Co. Power Press, No. 23. Located at U. S. A. S. B., Port Newark, N. J.

7—E. W. Bliss Co. No. 16 horning and wiring type Power Presses. Located at U. S. A. S. B., Port Newark, N. J.

SCREW MACHINES

2—Brown & Sharpe Mfg. Co. Automatic Screw Machines, No. "00G." Located at U. S. A. S. B., Port Newark, N. J.

4—Cleveland Automatic Machine Co. Automatic Screw Machines. No. 5024 size $\frac{1}{8}$ " "B" plain. No. 6786 size $\frac{1}{8}$ " "A" full. No. 3004, size $\frac{1}{8}$ " "B" plain, and No. 3494, size $\frac{1}{8}$ " "A" full. Located at U. S. A. S. B., Port Newark, N. J.

AUCTION SALE

AT

NIXON NITRATION WORKS

NIXON, N. J.

Beginning Wednesday, July 7, 1920, at 11 A. M.

| | |
|----------------|------------------------|
| 250,000 lbs. | Barium Nitrate |
| 250,000 lbs. | Aluminum Bronze Powder |
| 2,000,000 lbs. | Scrap Brass |
| 400,000 lbs. | Cartridge Cases |
| 125,000 lbs. | Scrap Copper |
| 750,000 lbs. | Scrap Brass |
| 400,000 lbs. | Scrap Lead |

Miscellaneous materials, stoves, electrical equipment, etc.

For further information apply to Committee on Sale of Materials, N. Y. Dist. Ordnance Salvage Board, 1107 Broadway, New York City, or Mr. Alfred Freeman, Auctioneer, 149 Grand St., New York City.

Write TODAY for latest current BULLETIN

War Department

ORDNANCE SALVAGE BOARD

Surplus Property Sales



CHICAGO DISTRICT—74th & Ashland Ave. Tel.—Vincennes 3500

ENGINE LATHES

Six Canada Mach. Corp. 26" x 10'. 3 step cone double back gears, compound tool rest, quick change gears. Location: Chicago Storage Depot.

HEAVY DUTY ENGINE LATHES

Three R. K. LeBlond Mach. Tool Co. 21" x 8', 3 step cone, double back gears, quick change gears, 4 way tool turret post, equipped with special air chuck and profiling attachment. Location: Chicago Storage Depot.

Two Lodge & Shipley, 30" x 38'. special gun lathe. Location: Northwestern Ord. Co., Madison, Wis.

LO-SWING LATHES

Two Fitchburg Mach. Co., 8" x 108". geared head, single pulley. Location: Chicago Storage Depot.

TURNING LATHES

Seven Niles-Bement-Pond Co., 30" x 13'. Axel turning lathe, double. Location: Chicago Storage Depot.

TURRET LATHES

Four Steidle Turret Mach. Co. 24" x 8', 6 1/4" hole spindle, without carriage. Location: Chicago Storage Depot.

Two Steidle Turret Mach. Co., 24" x 8', 6 1/4" hole in spindle. Location: Chicago Storage Depot.

Four Steidle Turret Mach. Co., 24" x 10', 6 1/4" hole through spindle. Location: Chicago Storage Depot.

NICKEL STEEL

Lot 3616—Approx. 58138 lbs. 5-8" round nickel steel 14' to 18' long. 70105 lbs. 11-16" round nickel steel 14' to 18' long. Location: La Salle Steel Co., La Salle, Ill.

SCRAP STEEL

Lot 3496—Approx. 596,505 lb. steel scrap. Location: Diamond Iron Wks., Minneapolis, Minn.

Chicago District offers for sale the items listed on this page only.

AT FIXED PRICES

No Delays No Restrictions

The information covering machines and equipment listed on this page has been obtained from the best sources available. The Government invites inspection before purchase, and assumes no responsibility as to conditions or completeness.

All machines and equipment listed on this page are subject to prior sale. No options will be granted.

SALES WILL BE MADE FOR CASH ONLY

Information regarding inspection, location, etc., may be obtained upon application to Chicago District Ordnance Salvage Board, 74th St. & Ashland Avenue, Chicago, Ill. Phone, Vincennes 3500.

The Chicago District also offers for sale additional surplus machinery and metal items, miscellaneous power, electrical, chemical, hardware, and shop equipment items, all of unusual interest to machine shops and metal working plants. Send for the latest Chicago District Bulletin which gives complete details.

CHUCKING GRINDERS

Three Bryant Chucking Grinder Co. Internal Grinder No. 10. Location: Chicago Storage Depot.

PLAIN CYLINDRICAL GRINDER

One Cincinnati Grinder Co., No. 4. 72" x 12". Location: Chicago Storage Depot.

One Cincinnati Grinder Co., 16" x 80". Location: Twin City Forge & Foundry Co., Stillwater, Minn.

One McDonough Mfg. Co., 18" x 50". Sterling power feed. Location: Chicago Storage Depot.

MILLING MACHINES

Two Ingersoll Milling Mach. Co., 30" x 24" x 10'. Double vertical adjustable rail arranged for 15 HP motor drive, hand and power drive. Location: Chicago Storage Depot.

AUTOMATIC SCREW MACHINES

Two Windsor Machine Co., Gridley auto, single spindle 2 3/4", 4 tool turret. Location: Chicago Storage Depot.

Four National Acme Co., Gridley auto, 2 3/4", 4 tool turret, single spindle. Location: Chicago Storage Depot.

HAND SCREW MACHINES

Two Greenlee Mach. Tool Co. 2 1/4" x 26. Flat turret for bar stock. Location: Chicago Storage Depot.

Two Cleveland Auto Screw Mach. Co. Single spindle, 5 hole turret, No. 57-2 1/4 x 3 1/4. No. 65-2 1/4 x 2 3/4. Location: Chicago Storage Depot.

to any District Office—see 1st page of this Advertisement

War Department

ORDNANCE SALVAGE BOARD

Surplus Property Sales



PHILADELPHIA DISTRICT— 1710 Market Street
Tel.—Locust 5120

METALS

BRASS CARTRIDGE CASES

Lot 1330—50,000 pcs. 75 m.m. Brass Cartridge Cases, 14 in. high, 3% in. base, 3 in. open top, 137,500 lbs. To be used for melting scrap purposes only. Analysis—Copper 70%; Zn. 30%.

Location: Woodbury General Ordnance Depot, Westville, N. J.

Lot 1331—100,000 pcs. 75 m.m. Brass Cartridge Cases, 14 in. high, 3 in. open top, 3% in. base, 275,000 lbs. To be used for melting scrap purposes only. Analysis: Copper 70%; Zn. 30%.

Location: Woodbury General Ordnance Depot, Westville, N. J.

Lot 1332—200,000 pcs. 75 m.m. Brass Cartridge Cases, 14 in. high, 3 in. open top, 3% in. base, 550,000 lbs. To be used for melting scrap purposes only. Analysis: Copper 70%; Zn. 30%.

Location: Woodbury General Ordnance Depot, Westville, N. J.

Lot 1333—400,000 pcs. 75 m.m. Brass Cartridge Cases, 14 in. high, 3 in. open top, 3% in. base, 1,100,000 lbs. To be used for melting scrap purposes only. Analysis: Copper 70%; Zn. 30%.

Location: Woodbury General Ordnance Depot, Westville, N. J.

BRASS RODS

Lot 1239—12,033 lbs. Hard Rolled Brass Rod, 13/16 in. 128,636 lbs. Hard Rolled Brass Rod, 3/4 in.

Location: Mays Landing General Ordnance Depot, May's Landing, N. J.

Lot 1240—254,134 lbs. Rd. Brass Rod, 3/4 in. 399,842 lbs. Rd. Brass Rod, 5/16 in.

Location: J. L. Mott Co., Trenton, N. J.

COPPER

Lot 1401—Approximately 42,752 pcs. 75 m/m Copper Bends unit weight .25 lbs. Total weight 10,688 lbs.

Location: Nitro General Ordnance Depot, Nitro, W. Va.

Lot 1404—Approximately 264,647 pcs. 4.7 in. Copper Base Covers, unit weight .129 lbs. Total weight 34,140 lbs.

Location: Nitro General Ordnance Depot, Nitro, W. Va.

Lot 1406—Approximately 100,012 pcs. 155 m/m Mark IV. copper base covers, unit weight .151 lbs., total weight 15,102 lbs.

Location: Nitro General Ordnance Depot, Nitro, W. Va.

LEAD-ANTIMONY

Lot 1414—Approximately 5,078,473 pcs. Bouchon assemblies (Lead-Antimony Components) total weight 900,155 lbs. Location: Nitro General Ordnance Depot, Nitro, W. Va.

STEEL

Lot 1326—Approximately 60,000 lbs. Steel Bars, 7 in. x 6 in. x 24 1/2 in. long. Analysis: C. .50-.60; M. .40-.80; Phos. .05; SV. .06; Si. .10-.30. Location: Bethlehem Steel Co., Bethlehem, Pa.

Lot 1327—Approximately 67,500 lbs. Steel Bars, 7 in. x 6 in. x 24 1/2 in. long. Anal.: C. .50-.60; M. .40-.80; Phos. .05; SV. .06; Si. .10-.30. Location: Bethlehem Steel Co., Bethlehem, Pa.

STEEL SCRAP

Lot 1412—60,597 pcs. 6 in. T. M. Shell adapters, steel (uncompleted), total weight 90,237 lbs. Location: Nitro Gen. Ord. Depot, Nitro, W. Va.

Lot 1413—Approximately 5896 pcs. 5 in. H. E. C. II steel shells, unit weight 64 lbs. total weight 377,344 lbs. Location: Nitro General Ord. Depot, Nitro, W. Va.

Lot 1259—1,072,500 pcs. 25 m/m (primed) Cartridge Cases, .0966 lbs. each. Total weight 103,604 lbs. Location: Nitro General Ordnance Depot, Nitro, W. Va.

ZINC

Lot 1029—8969 No. 7 gauge, 55% in. x 26% in. 46,639 lbs. Zinc Body Sheets. Location: Union Plant, Hercules Powder Co., Gillespie, N. J.

The Philadelphia District has also to offer for sale additional quantities of metals, machinery, and miscellaneous shop equipment, chemicals, and chemical equipment, electrical equipment, and hardware items. Complete details are in the latest Philadelphia District Bulletin. Sent on request.

MACHINERY GRINDERS

1—Heald Machinery Co., Worcester, Mass. Internal Grinder, No. 75, equipped with 3-jaw Universal chuck, hand feed, head stock Universal, for grinding parallel or taper holes. Maximum diameter of work will take 12 in. (cup wheel). Spindle has draw in bar for collets. Location: Frankford Arsenal, Frankford, Pa.

2—Middlesex Machine Co., Middletown, Conn. Universal Tool Grinder, with three-jaw independent chuck, largest diameter emery wheel will take 9 in., spindle equipped for two emery wheels, cross slide and table operated by hand wheel. Location: Army Reserve Depot, New Cumberland, Pa.

3—The Morse Twist Drill Co., New Bedford, Mass. No. 1 Plain Grinder, length of table 37 in. equipped with head and tail stock, 2-cone drive, one wheel mount with emery wheel attached, automatic feed, complete table has swivel gauge for taper grinding, pump attached, largest diameter with swing 4 in. Location: Army Reserve Depot, New Cumberland, Pa.

1—Willmarth & Morman, Grand Rapids, Mich. Size 88 in., spindle equipped with 2 wheel mounts, table and cross slide, automatic feed, vertical movement table operated by hand wheel, for cylindrical grinding (parallel and taper) countershaft, tight and loose pulleys. Dimensions of table 3 ft. 6 in. x 5 1/2 in. Location: Frankford Arsenal, Frankford, Pa.

HAND MILLER

2—Van Norman Machine Tool Co., Springfield, Mass. Miller, hand, size No. 1, 3 step cone, direct drive, overhanging arm with cast-iron bracket attached, cross slide operated by hand, table operated by hand lever, 2 adjustable table stops, crank handle for operating cross slide, table dimensions 22 in. x 5 1/2 in. Direct drive. Location: Frankford Arsenal, Frankford, Pa.

1—F. S. Perkins Co., Lowell, Mass. Lathe engine, size 26 in. x 10 ft., maximum over cross slide 15 in. plain tool rest, large face plate, 2 male centers, back geared, belt and gear feed for carriage, cross slide, double friction countershaft, plain geared lathe. Location: Frankford Arsenal, Frankford, Pa.

MACHINE LATHES

1—Niles-Bement-Pond Co., N. Y. City. Lathe engine heavy duty size 26 in. x 25 ft. Will swing over carriage 26 in. taper attachment, compound rest, steady rest back geared, face plate, 2 male centers, cross slide, carriage is equipped with friction feed, compound rest, operated by hand. Plain geared lathe countershaft tight and loose pulleys. Location: Frankford Arsenal, Frankford, Pa.

TURRET LATHES

1—Steinle Turret Machine Co., Madison Wis. 24 in. x 9 ft. four tool turret lathe, 118 in. chuck, 3 jaw automatic and hand feed carriage, screw for quick change gears, pump and piping, cast-iron chip pan 23 in. x 66 in. x 6 in. 2 step cone, friction drive (back geared drive). Location: Frankford Arsenal, Frankford, Pa.

Write TODAY for latest current BULLETIN

War Department

ORDNANCE SALVAGE BOARD

Surplus Property Sales



BOSTON DISTRICT— 19 Portland Street Army Wire

COLD DRAWN STEEL

372,000 lbs. (Approx.) 1 7/8 in. rd. Cold Drawn Steel. Location: R. B. Phillips Mfg. Co., Worcester, Mass.

914,778 lbs. of 1 7/8 in. rd. Cold Drawn Bessemer. Location: Chapman Mfg. Co., Winchester, Mass.

See the first page of this advertisement for general sales conditions. Quote price per net or gross ton F.O.B. cars shipping point. Shipments of this material shall begin within ten days, in so far as possible, from the date of the award and continue at a steady rate to the best ability of the Government.

The material can be inspected before the date of sale at locations designated. Failure to inspect will not warrant rejection.

The U. S. Government reserves the right to accept or reject any and all bids or any portion thereof, and to waive all technicalities.

BRIDGEPORT DISTRICT— 245 Main Street Tel. Noble 791

CHUCKING AND TURNING MACHINE

1—Potter & Johnson, No. 6A Auto. Chucking and Turning Machine. Location: U. S. Government Warehouse, No. 193, Bridgeport, Conn.

THREADING LATHE

1—Automatic Machine Co., 12" x 4" Threading Lathe. Location: U. S. Government Warehouse No. 193.

MILLERS (Automatic)

1—Pratt & Whitney, 12", Heavy Type. Location: U. S. Government Warehouse No. 193, Bridgeport, Conn.

PROFILERS

3—Pratt & Whitney, No. 14, 3 Spindle Profilers. Location: U. S. Government Warehouse No. 193, Bridgeport, Conn.

The Bridgeport District has also additional quantities of machinery, power and miscellaneous shop equipment for sale. If interested send for the latest Bridgeport District Bulletin, which gives full details.

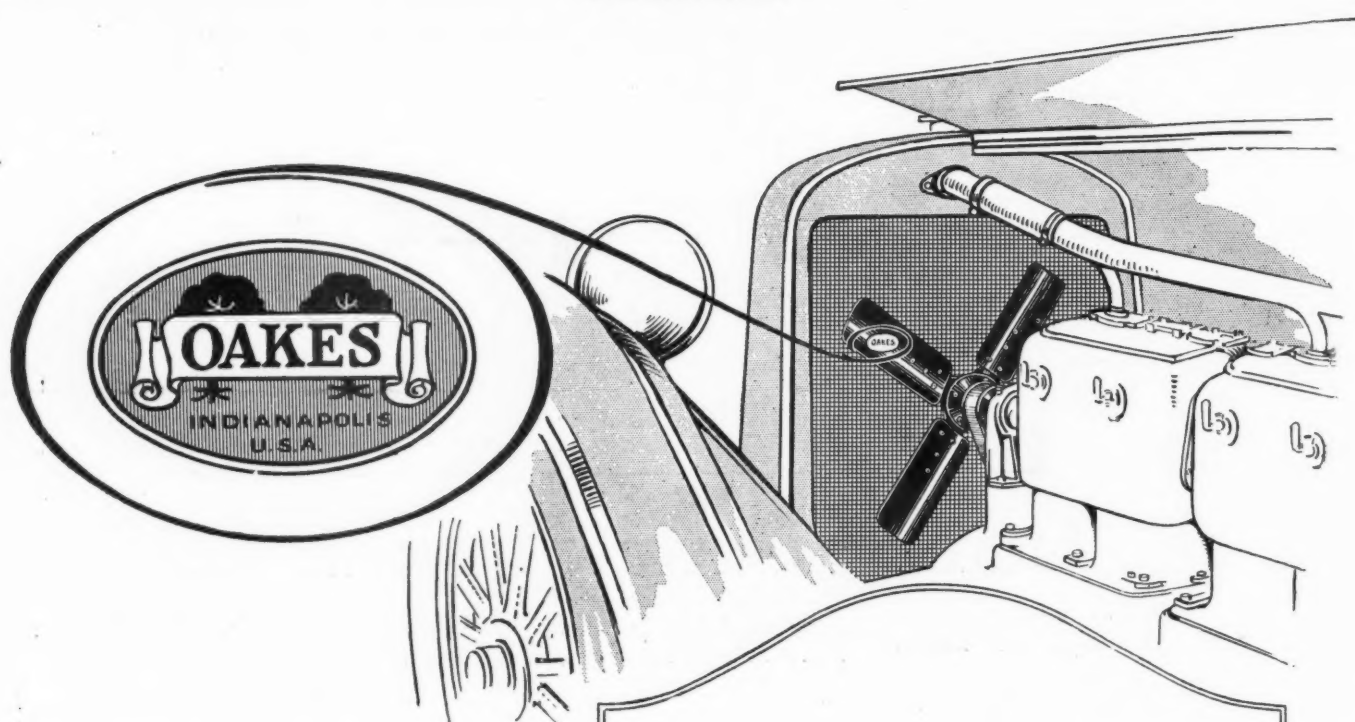
GENERATOR

1—85 K.W. General Electric D.C. Generator. 250 Volt, Compound Wound, 750 R.P.M., Belt Driven, complete with Pulley Rails and Blue Vermont marble operating panel with Rheostat, Instruments and Circuit Switches. All in first-class order. Location: Springfield Armory, Springfield, Mass.

BLOWERS

2—Blower Special. Two Beach-Russ No. 10 Belt Driven Pressure Blowers, 500 cu. ft. per minute capacity at 5 lbs. pressure. Practically new. Location: U. S. Government Warehouse No. 193, Bridgeport, Conn.

to any District Office—see 1st page of this advertisement



This name on a fan is your guarantee that it was produced at "Fan Headquarters." It is the mark of fan quality ~ backed by dependable cooling service on over 1,500,000 of America's finest motor vehicles.

PACIFIC COAST REPRESENTATIVE:

A.H.COATES CO. 41 SPEAR ST.
SAN FRANCISCO

The OAKES COMPANY
Indianapolis, U.S.A.

*Efficient
Cooling*
Oakes Fans



Send for this book—

We have prepared a valuable book: "Making Your Factory Larger Without Adding More Men, Floor Space or Machinery." Sent anywhere on request.

Needed a Bigger Factory—

STELLITE LATHE TOOLS mean increased production in every plant in which they are used—and mean a lower manufacturing cost. When a plant that has been operating with the use of high-speed steel adopts Stellite it becomes a bigger factory—at no increase in floor space, men or machinery.

Most American manufacturers know that Stellite is an alloy of cobalt and chromium, containing no iron. It is harder than the hardest steel, is not affected by heat up to 1800° F., cannot rust, and will out-last and out-work lathe tool metal of any other material.

Lathes that are Stellite equipped can be run at much higher speeds than lathes equipped with high-speed steel. Stellite tools remain sharp under conditions which would cause a steel tool to fuse, burn and become useless. Stellite tools last much longer between grindings.

Up to 1800° F., Stellite tools may be operated at any heat. The faster the job runs the tougher they get and the better they cut. The man who is looking for a bigger factory, and who wants it at once, need only install Stellite on his lathes.

The Haynes Stellite Company
Kokomo, Ind.

STELLITE

Not Steel ~ But Its Master

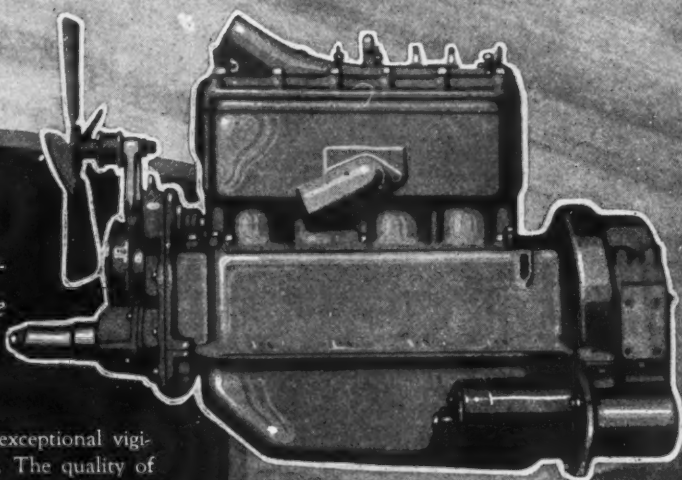


Imperfect metals can bring discredit upon the best of engine designing and building.

SO this becomes a matter for exceptional vigilance in the Lycoming plant. The quality of the metals entering into the construction of Lycoming Motors is certified by experienced metallurgists who inspect and test every shipment before it is passed to the foundry.

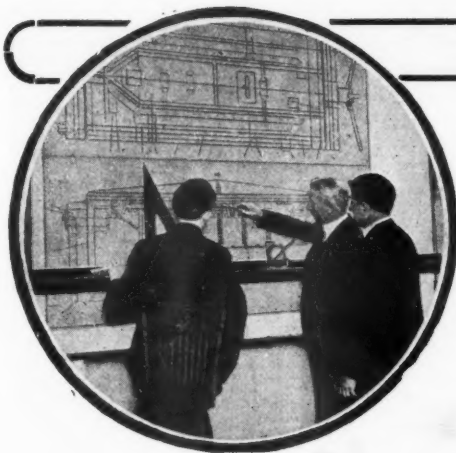
What it is made of ranks in importance with how it is made.

Lycoming Motors Corporation
Williamsport Pa.



**LYCOMING
MOTORS**

YOUR PRODUCTION SUCCESS BEGINS HERE



A Tool Designer Is Not Made Over Night

Nor is a tool builder.

This growth—this art—is the attainment of a lifetime with the engineering and working personnel of the Carroll organization.

Practical experience gained in every branch of industry, technical training in wide fields of science,—these elements combine in cumulative force to make Carroll Engineering Service Men ably qualified in the Automotive Field.

When the time comes that you need the best in production tools, you may rest assured that Carroll Service will guide you safely through all the critical stages, from blue print to beginning operations. Ask Carroll and you will get the best thought and the most efficient product that modern science and a wealth of practical experience can give.

If you set the date, a Carroll Service Man will call for a conference.



From this layout board your problem goes to our designing room, which is unexcelled, we believe.

THE CARROLL ENGINEERING CO.

Tool Engineers and Builders

DAYTON

OHIO

U. S. A.

New York, Foreign Sales,
American Machinery Syndicate, 37 West 39th Street

Carroll

ENGINEERING SERVICE

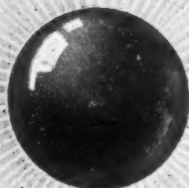
Carroll Service is talent and cumulative experience that insures the best in tools.

MR

MARLIN-ROCKWELL INDUSTRIES

MR

The Most Perfect Spheres Ever Made



*Chrome Alloy Steel Balls as developed
by new S. R. B. processes especially for*



Single Row

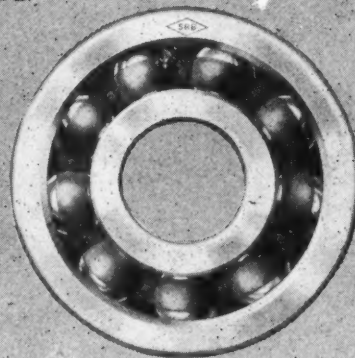
Double Row

ANNULAR BALL BEARINGS

ONE TEN-THOUSANDTH of an inch is equivalent to about one-thirtieth of the thickness of a human hair. This delicate measurement represents the limit of error allowed by the standards of accuracy established by engineers for steel balls used in highest grade ball bearings. No two balls in such a bearing may vary more than that. Yet S. R. B. practice has far surpassed even this exacting standard.

S. R. B. accuracy has attained a point where the liquid measuring gauges which plainly show variations down to fractions of $1/10,000$ inch fail to register any variation whatsoever either as to diameter or sphericity.

You will find S. R. B. Bearings in those motor cars, trucks and tractors whose names are instantly thought of as leaders in their respective fields. The same is rapidly becoming true as regards the leading makes of high-speed industrial equipment, machines and motors.



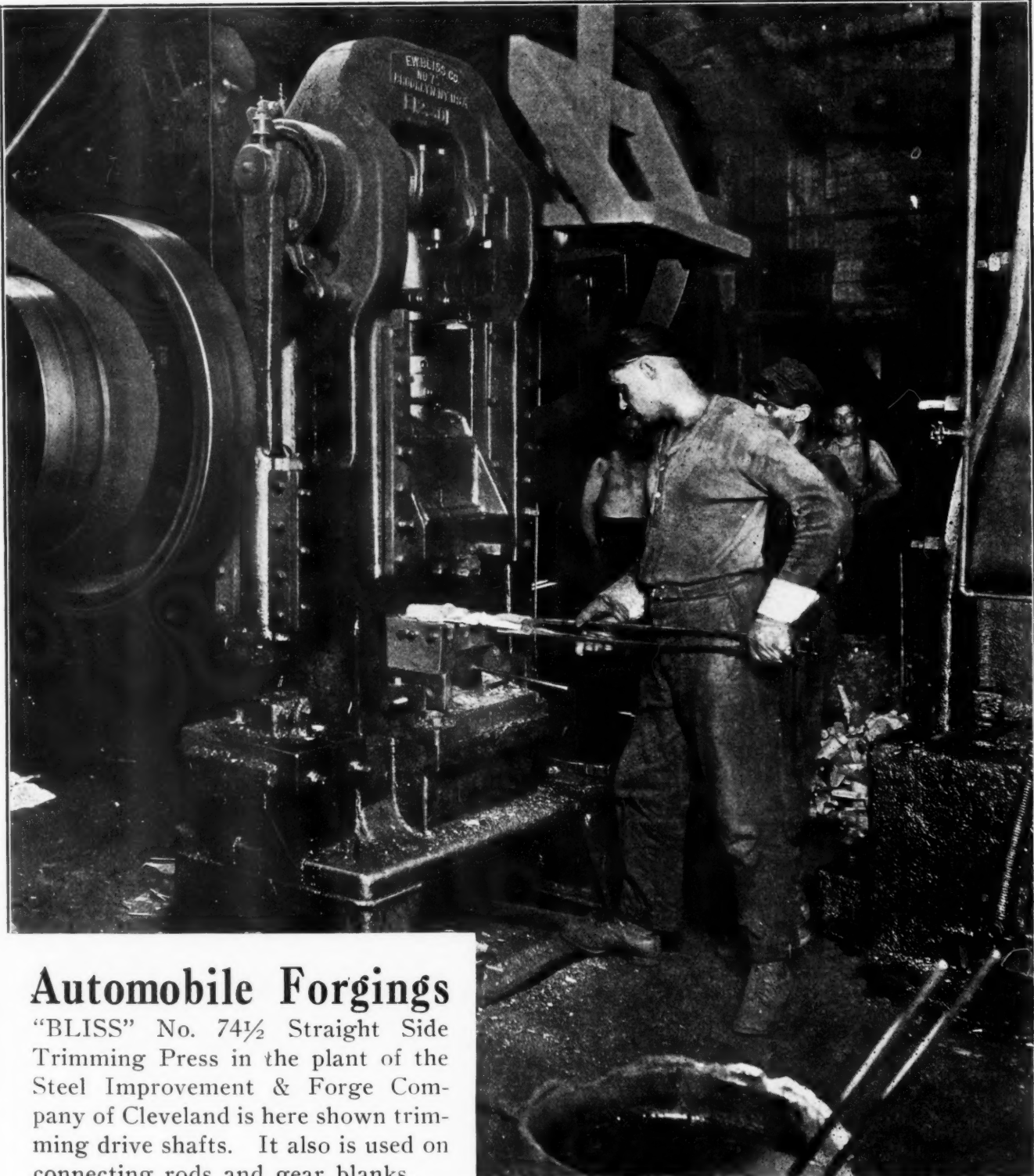
STANDARD STEEL AND BEARINGS INCORPORATED

Philadelphia Plainville, Conn. Norwich, Conn. New Haven, Conn. Pittsburgh
Standard Roller Bearing Co. Standard Sales and Service Distributors in Principal Cities Braeburn Steel Co.

Executive Offices: 347 MADISON AVENUE, NEW YORK CITY

Controlled and Operated by

MARLIN-ROCKWELL
C O R P O R A T I O N



Automobile Forgings

"BLISS" No. 74½ Straight Side Trimming Press in the plant of the Steel Improvement & Forge Company of Cleveland is here shown trimming drive shafts. It also is used on connecting rods and gear blanks.



1857

E. W. Bliss Company

Main Offices: BROOKLYN, N. Y., U. S. A.

American Factories: BROOKLYN, N. Y., and HASTINGS, MICH.

SALES OFFICES

CHICAGO, People's Gas Bldg.
CINCINNATI, Union Trust Bldg.

DETROIT, Dime Bank Bldg.
BUFFALO, Marine Bank Bldg.

CLEVELAND, Union Bank Bldg.
ST. LOUIS, Boatmen's Bank Bldg.
PITTSBURGH, Keenan Bldg.



1920

FOREIGN SALES OFFICES and FACTORIES

LONDON, ENGLAND, Pocock Street, Blackfriars Road, S. E. PARIS, FRANCE, 100 Boulevard Victor-Hugo, St. Ouen No. 70.

NEW DEPARTURE

Ball Bearings



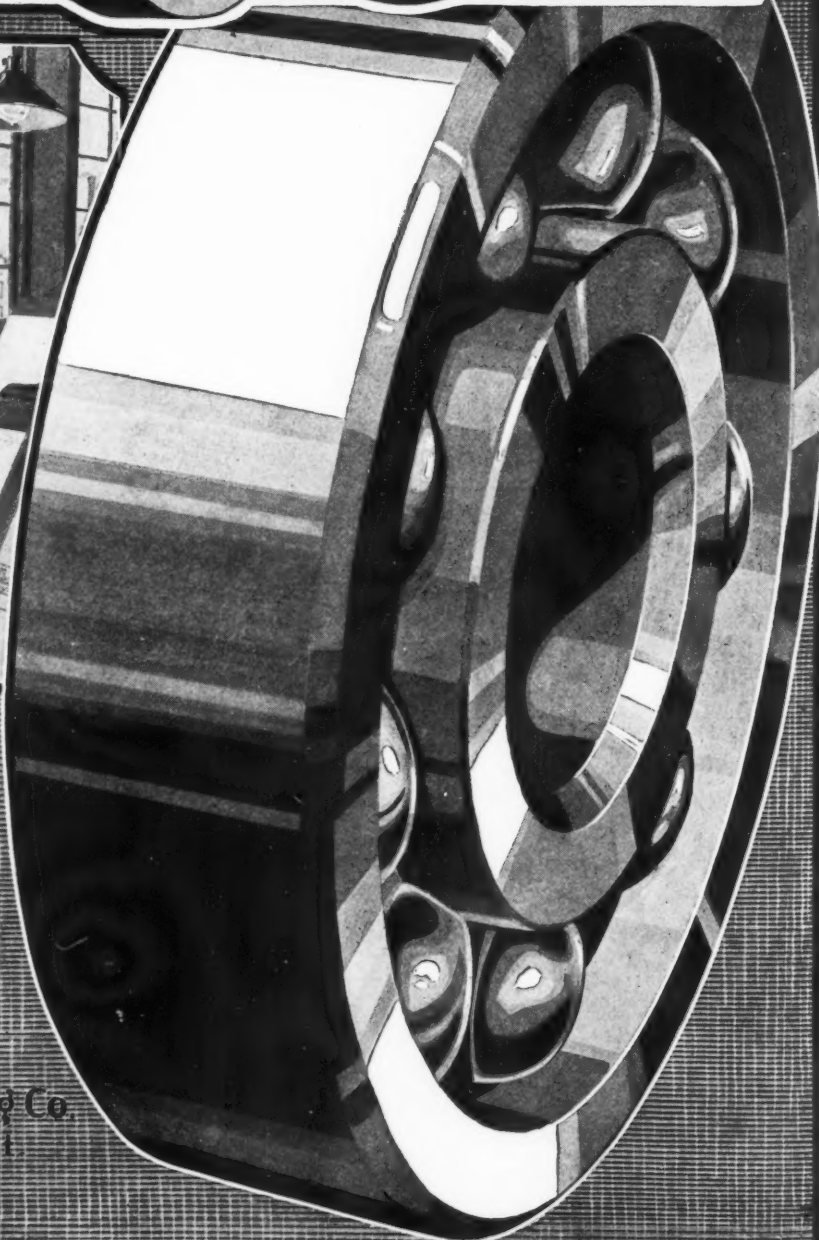
A minimum of friction and splendid wearing qualities are a rare combination in a bearing.

Yet, these are the strong points of the New Departure. There is no need to take this on faith. Examples of the satisfaction New Departures are giving are in every hand.

CONRAD PATENT LICENSEE

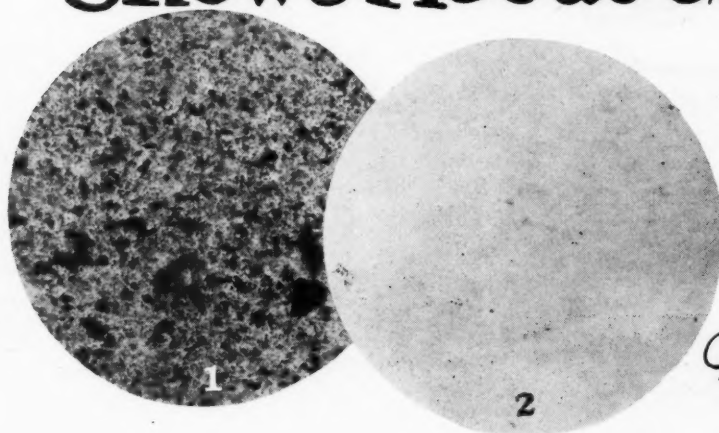
594

New Departure Manufacturing Co.
Bristol, Connecticut.
Chicago, Detroit.





What the Microscope Shows About Grease



*Actual
Photographs*

THESE photographs show in a graphic, impressive manner just why the Alemite High Pressure Lubricating System is the most efficient method of chassis lubrication ever devised.

No. 1 is a photograph of old grease that was forced from a bearing by the Alemite High Pressure System. Note the particles of dirt, grit and metal throughout the grease. If allowed to remain in the bearing they would have the same effect as a lapping compound, slowly grinding away the bearing surface and retarding lubrication. This is what actually happens when ordinary grease cups are used, because sufficient pressure cannot be attained to force the old grease out. When the Alemite System is installed a few turns of the compressor handle force the old grease out under pressure of 500 lbs. or more per sq. in. if necessary.

Our lubricating engineer is at the service of automotive engineers and manufacturers. A request for complete information implies no obligation.

THE BASSICK MANUFACTURING CO.

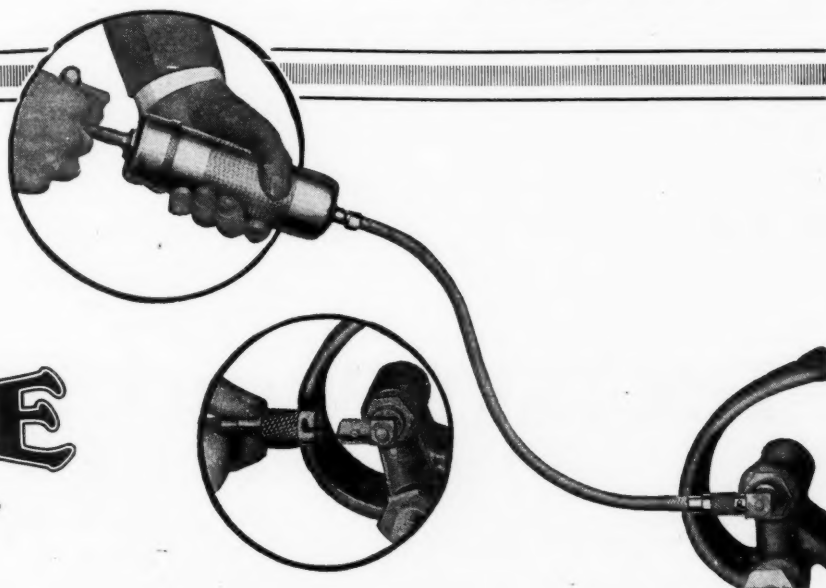
Manufacturers

361 W. Superior St.

Chicago, U. S. A.

HIGH PRESSURE
ALEMITE
LUBRICATING SYSTEM

"CLEANS—THEN LUBRICATES"





Close-up of Martell Aligning Reamer in position. Individual reamer shown at side.

Ream the Bearings in $\frac{1}{6}$ the Time of Hand Scraping

This ratio of labor saving over bearing scraping is the usual story of economy that follows the use of the Martell Aligning Reamer.

Another and even more important feature of the Martell Method of reaming bearings is this: Every bearing is reamed in perfect alignment, an almost impossible condition with

hand scraping even when the utmost care is exercised.

The Martell Reamer is so designed that the blades can be accurately adjusted and their location permanently maintained. Any number of bearings reamed simultaneously by using gang of reamers and the finished alignment is correct to 0.00025 in.

Perfect Alignment

Correct Gear Meshing
At a 75% to 95% Saving of Labor

Longer Life to Bearings

Send for Bulletin 101 L.

THE TAFT-PEIRCE MFG. COMPANY

WOONSOCKET



RHODE ISLAND, U.S.A.

New York—Woolworth Building.

Chicago—First National Building.

Detroit—Majestic Building

TAFT-PEIRCE PRODUCTS CARRIED IN STOCK BY Syracuse Supply Co., Syracuse, Buffalo, Rochester; Cadillac Tool Co., Detroit; Sherritt & Stoer Co., Philadelphia; Wm. M. Pattison Supply Co., Cleveland; Northern Machinery Co., Minneapolis; Mid-West Machine & Tool Supply Co., Davenport, Iowa.



FINISH —

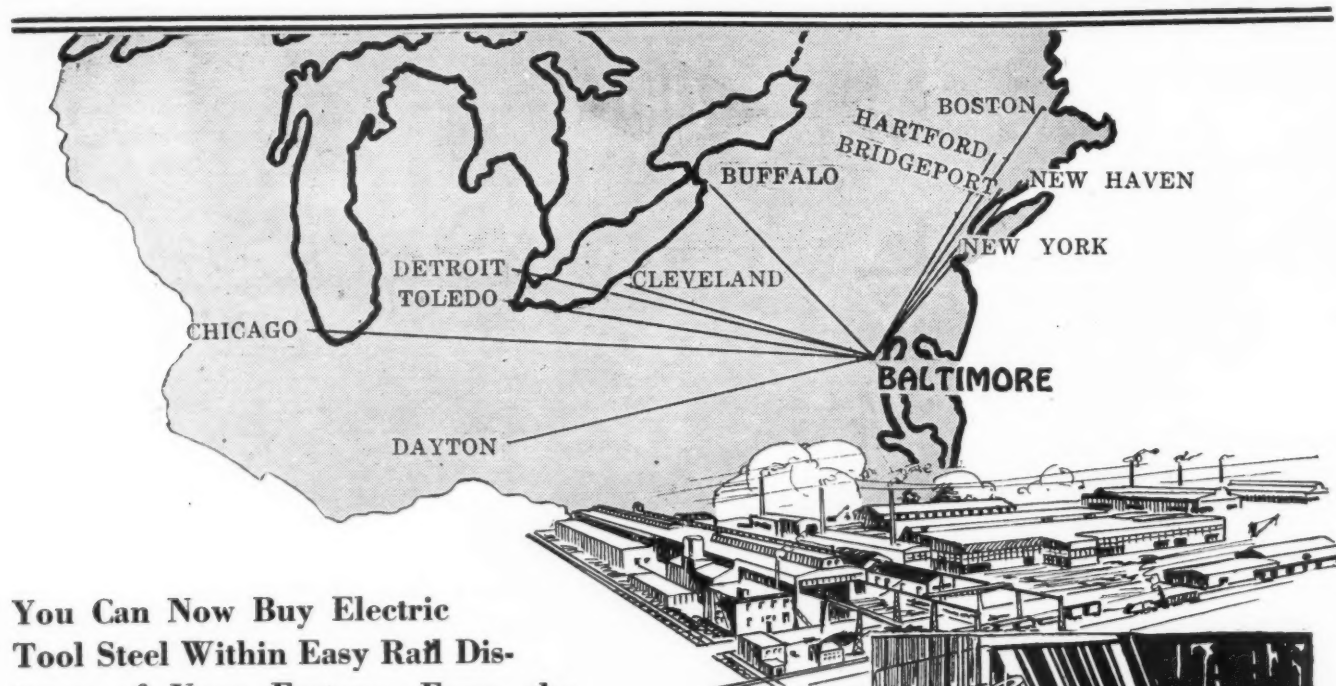
While the glistening finish of the new car as it moves out of the factory, ready for use, is a matter we take pride in, we set our mark considerably higher than this. It is the veteran of several seasons' battle with sun and rain and dirt—that shows us our work is good.

This—and the fact that over seven hundred thousand cars were finished last year from the metal out with Flint Products.

FLINT

VARNISH & COLOR WORKS

FLINT · MICHIGAN



You Can Now Buy Electric Tool Steel Within Easy Rail Distance of Your Factory, From the Largest Cold Melt Electric Steel Plant in the Country.

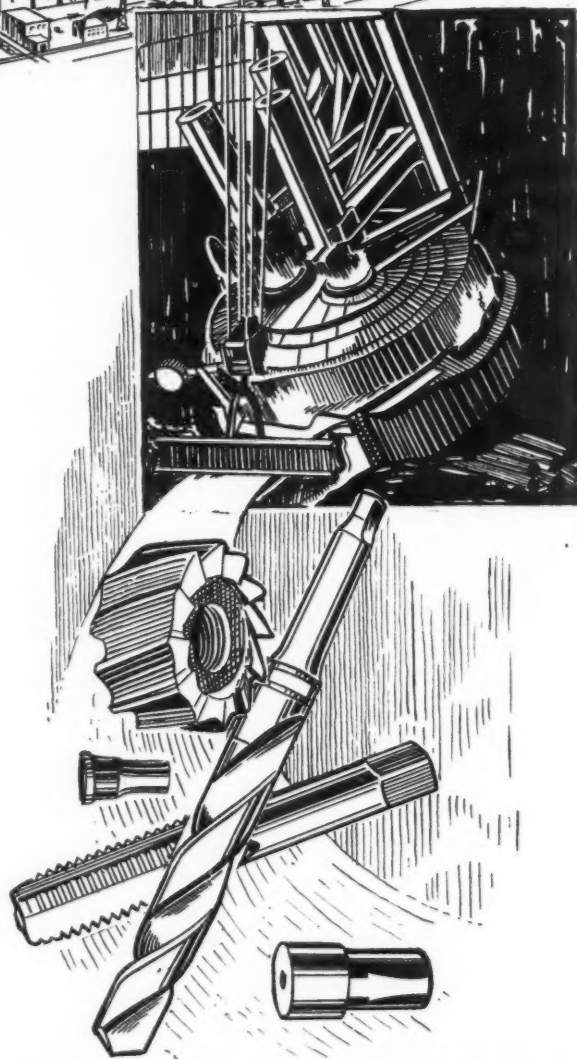
To the tool steel distributor and the large steel tool manufacturer the proximity of our plant at Baltimore means much to you in saving time, production and money.

Hess Cold Melt Electric Steel enjoys a reputation in automotive circles for uniform quality, freedom from impurities that makes it especially desirable for the tool steel distributor and the steel tool manufacturer.

Exceptional plant equipment, as well as natural shipping facilities, makes our tool steel plant an attractive adjunct to either the distributor or the manufacturer, because we can fulfill promises of prompt shipments.

If you will acquaint us with your requirements we will gladly suggest special steels and individual brands for your exclusive use.

THE HESS STEEL CORPORATION
BALTIMORE MARYLAND



HESS TOOL STEEL

cold melt electric

CONNECTICUT

IGNITION

SIMPLY PUSH THE BUTTON WHEN
YOU WANT TO START AGAIN



How the Automatic Switch Insures Your Ignition

You forget to turn off your ignition often enough to create a real danger to the system; but forgetting makes no difference to the Connecticut system. When the motor stops the continued flow of the current heats the thermostatic arm of the Connecticut Automatic Switch, causing it to expand, throwing off the plunger and breaking the circuit.

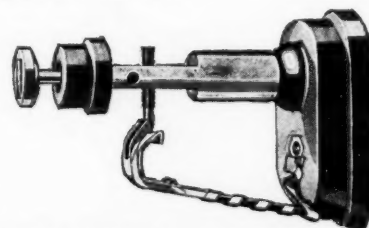
This thermostatic arm is composed of bronze welded to steel. The bronze expands more rapidly under heat than the steel, and this uneven expansion *automatically* snaps off the plunger, stopping the flow of current immediately.

It is a simple mechanism, infallible in operation, and requires neither thought nor attention—except to push the plunger back when you want to start again.

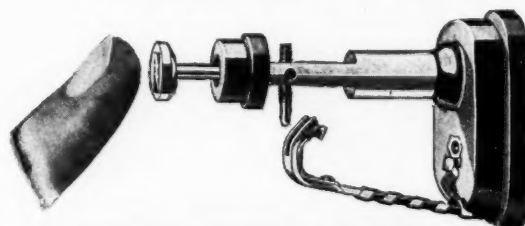
The automatic switch thus permanently protects both coil and battery. Therefore the Connecticut system, free to deliver full current, furnishes a hot, fat, eager spark at all motor speeds.

It should be on the next car you buy.

MOTOR RUNNING, CURRENT FLOWING, THERMO-
STATIC ARM IN POSITION



MOTOR STOPPED, EXPANSION OCCURRING IN THERMO-
STATIC ARM, WHICH IS JUST ABOUT TO RELEASE PLUNGER



PLUNGER OFF, CURRENT STOPPED—PUSH IT BACK
WHEN YOU WANT TO START AGAIN.

CONNECTICUT **TELEPHONE & ELECTRIC COMPANY**
Meriden Connecticut

Certainty

Within the small compass of a bolt or nut there are factors which can make or mar the efficiency of a big machine.

No assembly of metal parts has any security against accident, beyond that which lies in the integrity of its bolts and nuts. A flaw here can have disastrous consequences.

You can afford no speculation, where efficiency is in the balance. *Certainty* is a necessary safeguard.

There is nothing speculative about the quality of Empire Bolts and Nuts. Their staunch virtues have become a world wide tradition, through 75 years of service in every conceivable line of industry.

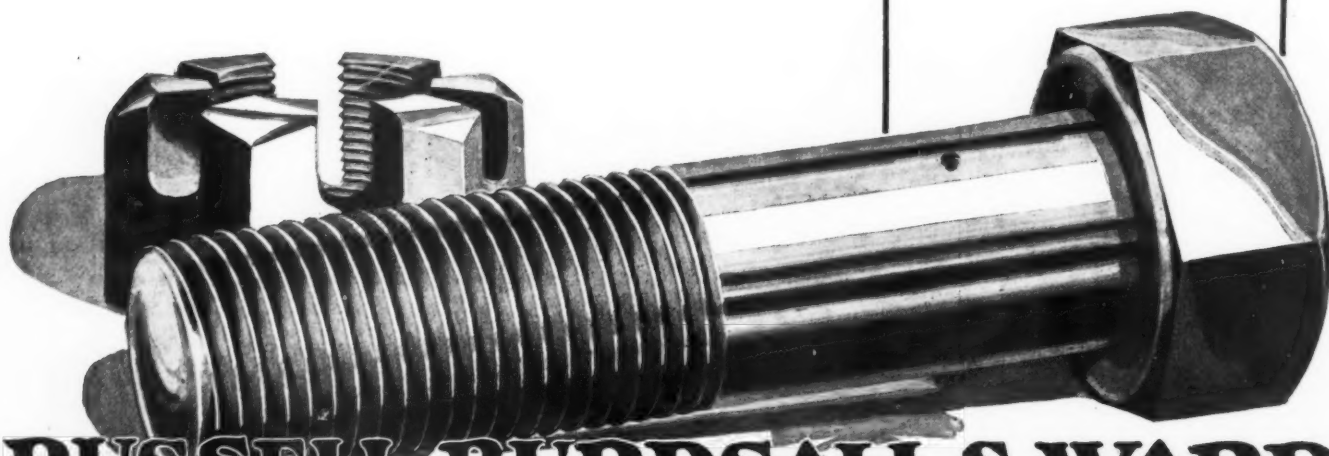
Specify Empire, and have the gratifying assurance of undoubted worth.



Since 1845

The origin of Empire Bolts and Nuts dates back to October, 1845, when the first plant of the Russell, Burdsall & Ward Bolt and Nut Company was opened.

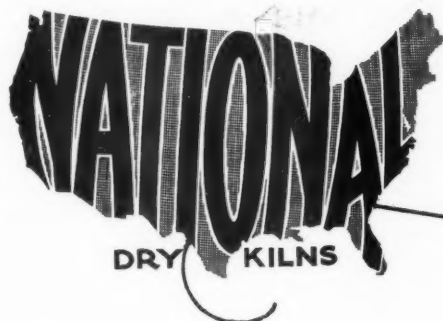
On this pioneer foundation the company has erected facilities of a kind and extent that enable it to produce the highest grade Bolts and Nuts in the world.



RUSSELL, BURDSALL & WARD
BOLT & NUT COMPANY

PEMBERWICK, CONN. PORT CHESTER, NEW YORK ROCK FALLS, ILLINOIS

Makers of Bolts, Nuts and Rivets Since 1845



*That the beauty of
your coach-work shall
endure. ~ . ~ . ~*

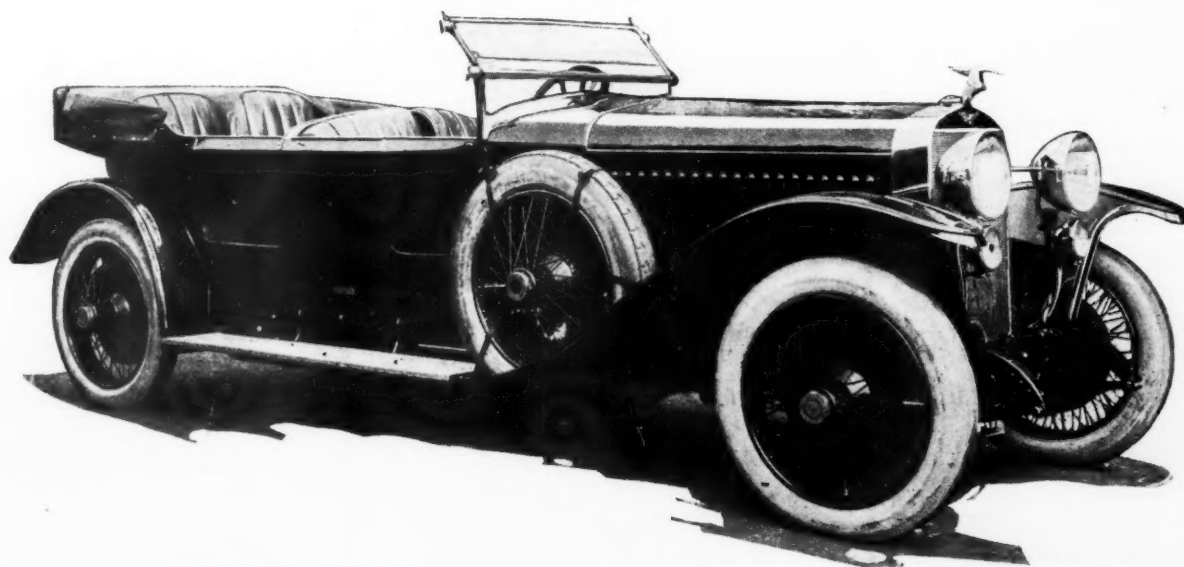
It is essential that the fine woods of the finish and the strong timbers of the foundation be correctly seasoned.

Yet that seasoning must not take too long. Capital and credit must not be tied up in large reserves of lumber. Neither may the stock be weak, checked, unworkable, lest your prestige suffer.

National Dry Kilns are the means of avoiding both extremes. Twenty years of thought, study, and knowledge are built into them.

National Dry Kilns are now in use at the plants of the General Motors Corporation, the Buick Motor Company, The Dort Motor Car Co., the Andrew C. Sisman Co., the Ford Motor Co., The Baker R & L Co., and others equally known, which lack of space denies mention.

Our advisory staff, slowly built up of men who have served us long, is at your command. Without obligation, you may call upon us for their services. To do so immediately will be to your material advantage.



The NATIONAL DRY KILN COMPANY

INDIANAPOLIS

1136 East Maryland St.,

INDIANA



*A Few of the
widely varying parts on
which you can get phe-
nomenal production*

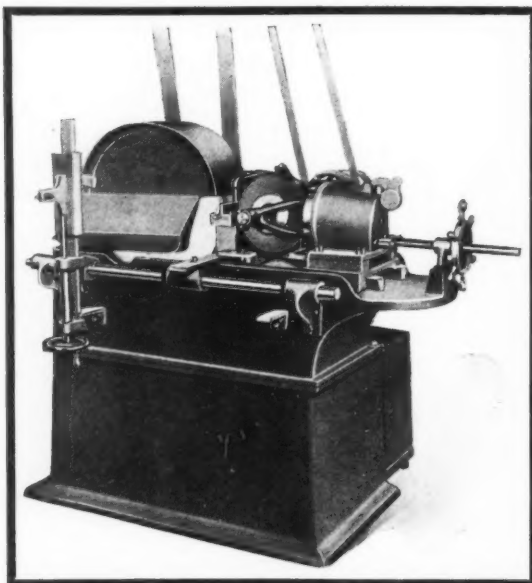
Grinding cylindrical pieces on the SANFORD means greater accuracy, higher finish, bigger production and an ease of maintenance which means that the SANFORD is doing its good work all day long.

Users of this machine have the minimum of idle machine time to reckon with.

Sanford

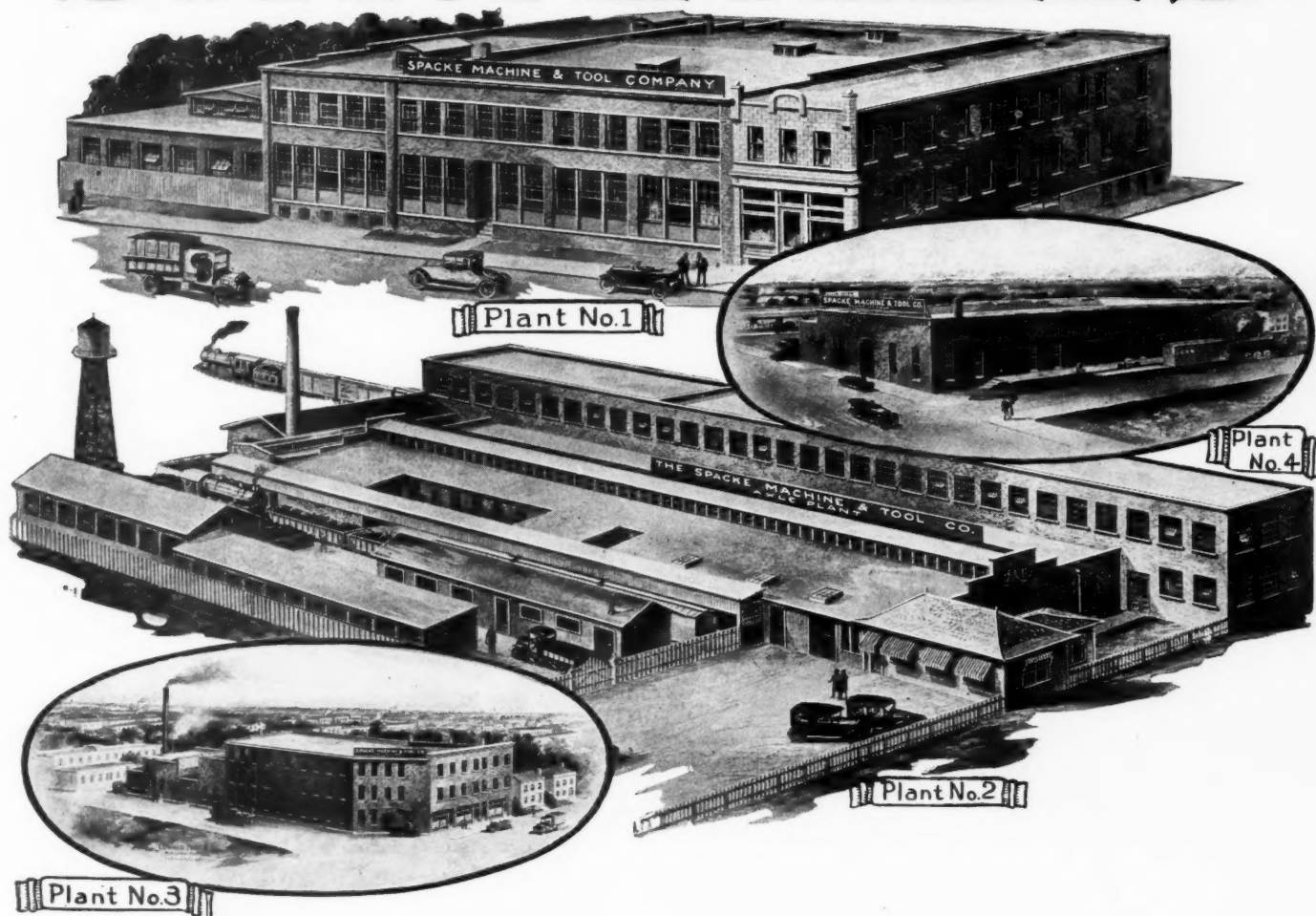
PRECISION CENTERLESS CYLINDRICAL GRINDERS

Know this machine in detail. It means a better product, faster production and more dollars of profit. Literature on request.



RUSSELL HOLBROOK & HENDERSON, INC.
30 Church Street New York

SPACKE AXLES



The great factories and modern equipment back of Spacke Axles insure workmanship and deliveries to the car manufacturer. But combined with Spacke features of design such as oilless bearings and Spacke materials, they insure the greatest service and satisfaction to the owner whose car is equipped with Spacke Axles.

Ask for the specification folder.

THE SPACKE MACHINE & TOOL CO.
Makers of Spacke Axles, Spacke Motors & Automotive Parts.
Factories & Offices ~ ~ ~ ~ Indianapolis-U-S-A

A Coil that's *Waterproof*

The coil of the new Westinghouse Type "SC" Standardized Ignition shuts the door to moisture troubles. It is entirely waterproof.

This coil is sealed in a water-proof composition tube, and is further protected by a steel base and a porcelain cap. While all parts are made to withstand high temperature as well as moisture, the internal temperatures of the coil are *exceedingly low*.

In the design and construction of this unit of the new "SC" Ignition System, there was need for just such skill and experience as has been accumulated by Westinghouse in more than thirty years of experience with insulation problems of every character.

For more detailed information be sure to get a copy of circular 1606. It will be mailed free on request.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
Automobile Equipment Department
General Sales Office, 110-114 West 42nd Street, New York City

Branch Sales Offices:
Cleveland, Ohio: 1900 Euclid Bldg.
Indianapolis, Ind.: City Trust Bldg.
Detroit, Mich.: Kresge Bldg.

Branch Sales Offices:
Chicago, Ill.: Conway Bldg.
Works:
Newark, N. J., and Springfield, Mass.



Westinghouse

STANDARDIZED IGNITION FOR AUTOMOTIVE VEHICLES

JOHNSON

Performance

That, in a nutshell, is the supreme test of any bushing.

Exhaustive tests—chemical and physical, made under every conceivable condition—enable us to recommend the correct bushing for every purpose that will insure absolute dependability, wear resistance, long service—renewal economy.

Write us for results of our performance tests.

JOHNSON BRONZE COMPANY

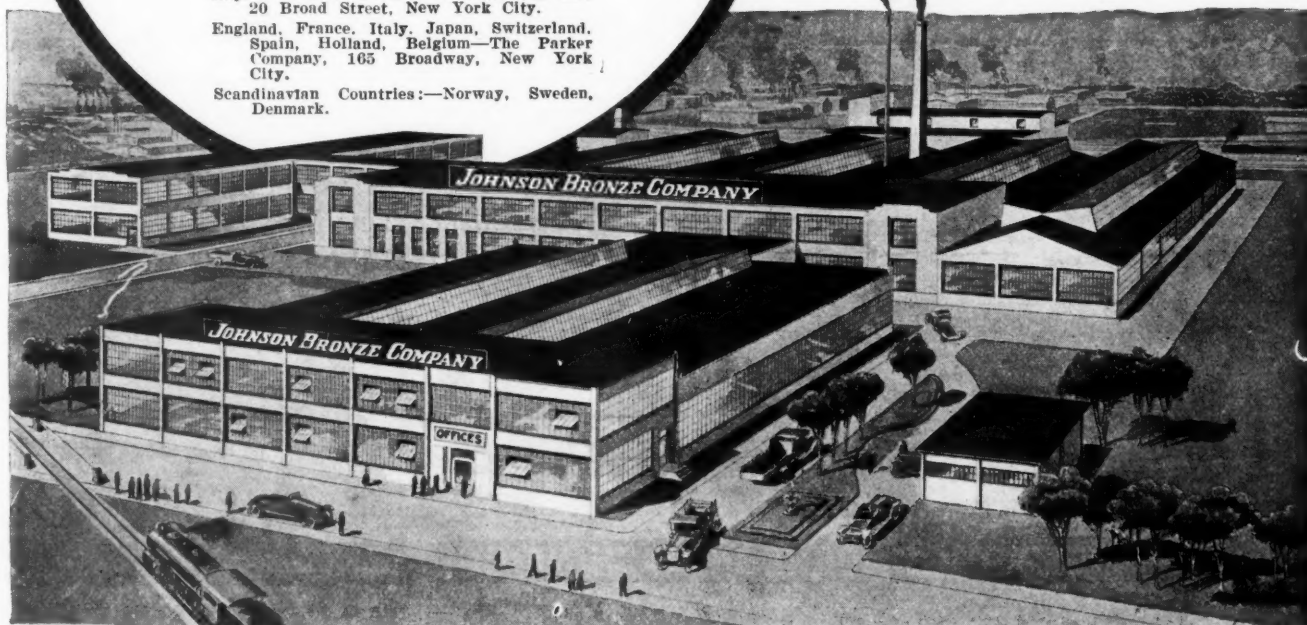
New Castle, Pa.

Sales Offices:—New York, Pittsburgh, Detroit, Chicago.

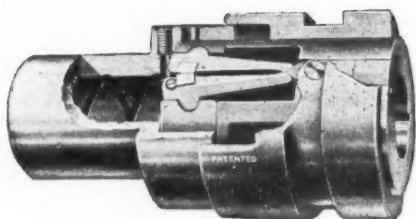
Export Offices:—J. E. Dockendorff & Co., 20 Broad Street, New York City.

England, France, Italy, Japan, Switzerland, Spain, Holland, Belgium—The Parker Company, 165 Broadway, New York City.

Scandinavian Countries:—Norway, Sweden, Denmark.



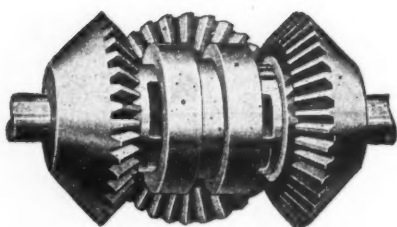
THE JOHNSON FRICTION CLUTCH



Single Clutch broken away.

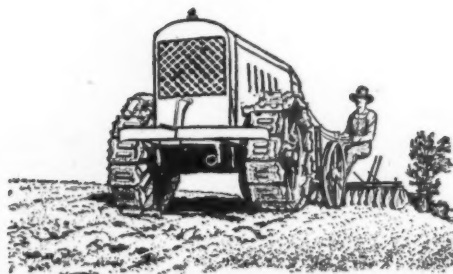


Double Clutch exterior.



Double Clutch in nest of bevel gears.

For overhead transmission and machine equipment there is no power control more reliable than the Johnson Friction Clutch. Look for it on the machines you buy. Let us send our booklet, "Clutches as Applied to Machine Building."



The Clutch That Controls The Machine Tool Is The Safest Clutch For The Tractor

Would you consider the opinion of the modern machine tool builder as a reliable guide in selecting proper friction control? Is there any place where accurate performance and unfailing service are more essential than in high grade precision machinery? Any situation where a friction clutch would be more thoroughly tested on its merits?

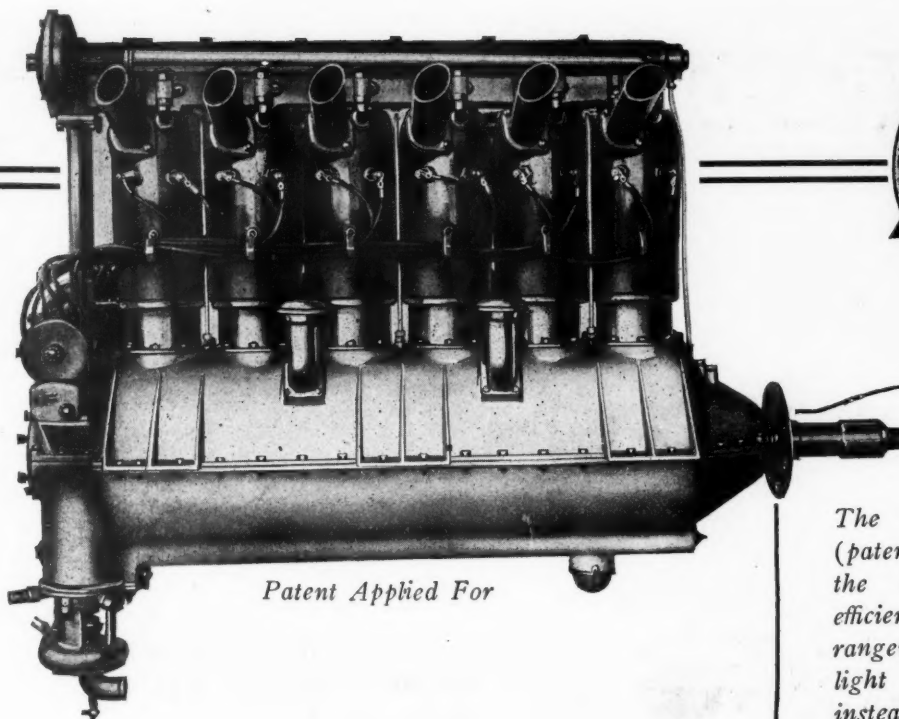
The Johnson Clutch is selected by a great majority of the leading machine tool manufacturers. You will find it wherever friction control is required, on the well-known *a u t o m a t i c s*, the lathes, boring mills, drilling machines and other types which hold commanding positions in their respective fields. It is the successful machine tool clutch.

If you need an auxiliary clutch on your tractor it will be worth your while to investigate the Johnson. Let us show you how compactly it can be assembled in your mechanism. Test for yourself how faithfully it will handle the work.

Write for our Catalog "M"



THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN



Patent Applied For



The valve mechanism (patent pending) offers the highest volumetric efficiency, a plunger arrangement of extremely light weight being used instead of rocker arms and push rods. Three gear pumps give oiling efficiency never before approached in a motor.

Ample Cooling, responsible for able performance in the air is obtained in the Rausie-E 6 Airplane Motor by new construction

Perfect water circulation makes a smooth running motor in all altitudes. And when the going is rough and the motor heats up more than ever, then is the time the pilot is glad that Rausie-E 6 design gives him plenty of radiation surface and every cooling opportunity possible.

The Rausie construction gives a water inlet to cylinder jackets, cast integral, and connected in series by a special rubber ring clamped in place. At the outlet, on top of jacket, the water is collected by a pipe connected to each cylinder by a hose joint. Circulation of water around valve ports has been well provided for by the location of the out-going water. The water pump and oil pumps are built into one unit, carried in the crankcase base. This base can be taken off easily, without disconnecting any piping, leaving the bearing free for inspection.

The water pump is driven at one and one-half engine speed by a vertical shaft geared to main driving gear. There is no chance for clogged water line.

The Rausie weighs 510 pounds. Every detail has been refined to give the Rausie first place in importance in commercial flying. The full specifications will be forwarded on request

The Steel Products Engineering Company
Springfield, Ohio

RAUSIE-E 6 AIRPLANE MOTOR





THE IRON AGE

OF AMERICAN
PUBLISHED ANNUALLY AT

SALES ABROAD

THE magnitude of the demand abroad for U. S. A. made products is almost incalculable. Plan NOW to secure YOUR share of this business which amounts to several billion dollars annually.

Acting as the connecting link, the medium for economically bringing overseas purchasers in contact with American Manufacturers, the IRON AGE CATALOGUE OF AMERICAN EXPORTS is a vital element in educating buyers abroad to place their orders here.

(1) It secures that co-operation necessary on the part of manufacturers to provide the overseas buyer with a comprehensive volume covering the products in which he is interested.

(2) For filing and reference it is more convenient than several hundred different manufacturers' catalogues.

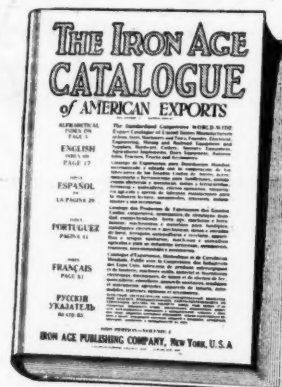
(3) Printed in the five commercial languages—English, French, Spanish, Portuguese and Russian, the translations are uniform, instead of being a varied assortment of interpretations found in any file of different catalogues.

(4) Catalogue data, illustrations, specifications, tabular matter, etc., are presented uniformly and in the way most desired by overseas buyers.

(5) It is distributed to 10,000 overseas buyers and users at less cost to you than the mailing alone of an individual catalogue. These 10,000 concerns that actually use and want U. S. made products were selected from almost a half-million names.

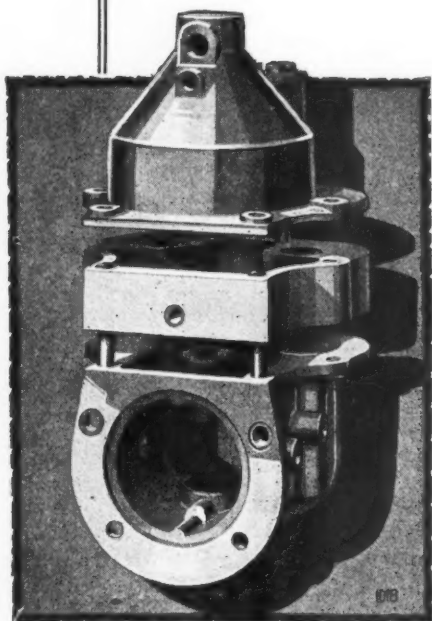
The 1921 Edition, now being compiled, will be limited to 1100 pages. As the last issue was greatly over-sold, arrange to take space before it is all gone.

Write, wire or phone for further information.



CATALOGUE EXPORTS

239 WEST 39TH ST., NEW YORK



The Die Castings You Can Best Afford to Use

You can no more take a chance on the quality of your die-castings than you can on the accuracy and finish of your machine work. You must have the best to protect the reputation of your product.

The Doehler Company produces only die-castings of that high quality on which you insist. However intricate the part, whatever the service conditions it must fulfill, if it can be made as a die-casting, you will want the Doehler Company to make it.

The Engineering and Manufacturing service of the company is at your disposal.

DDC-55

THE WORLD'S LARGEST MANUFACTURERS OF DIE CASTINGS

DOEHLER DIE-CASTING CO.

BROOKLYN, N.Y.

TOLEDO, OHIO.

CHICAGO, ILL.

SALES OFFICES IN ALL PRINCIPAL CITIES

Hartford
UNIVERSAL JOINTS
AND CONE CLUTCHES

*The Joint of
Universal Satisfaction*

The Hartford Automotive Parts Co.
Hartford, Conn. Incorporated 1906

K M C O

die-casts into bearings unaffected by scant lubrication

Conclusive proof of the excellence of KMCO is the order of the International Harvester Company, calling for five tons a day, to be used in their tractors and stationary engines.

These products go to farmers, who are, as a class, notoriously negligent in the matter of lubricating their machinery.

To maintain the I. H. C. reputation, these engine bearings had to keep friction losses low with a minimum of attention.

KMCO Was Chosen

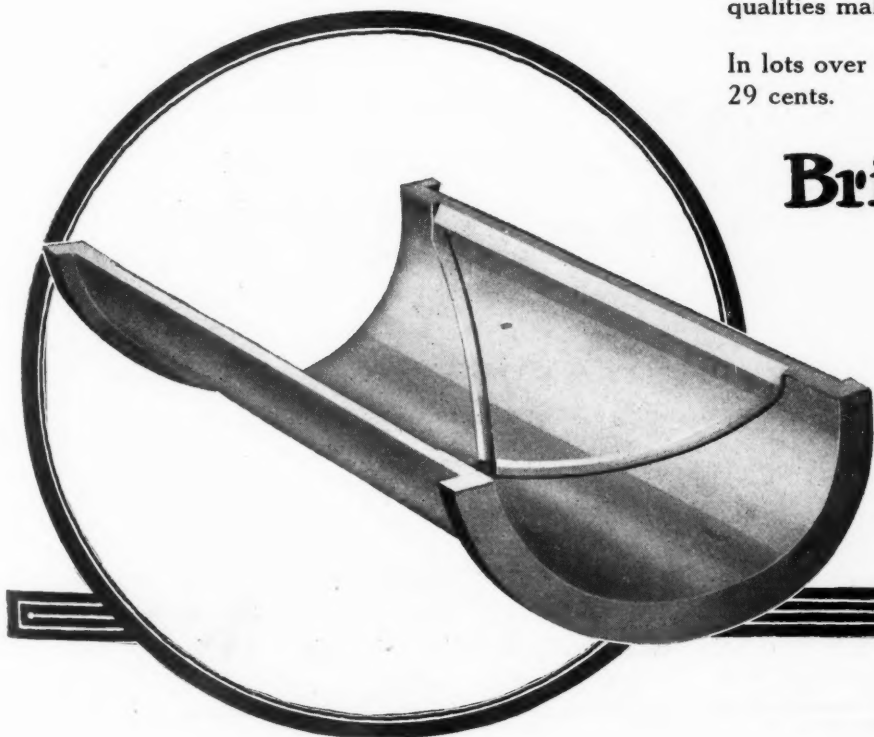
Though it fuses when abused, it does not score the shaft. Neither does it "crystallize" nor lose its homogeneity when fatigued. Its low price and die-casting qualities make replacement an insignificant item.

In lots over 5 tons, 25 cents per pound; under 5 tons, 29 cents.

Brinell Hardness 28-30

H. KRAMER & CO.

Smelters, Refiners, Metallurgists
1324-44 W. 21st Place
CHICAGO, ILL.



Thor

UNIVERSAL ELECTRIC DRILLS

Powerful—Yet Light

There's super-power in THOR Drills. Several exclusive THOR features are responsible. Still they are light, compact and easy to handle. You can reach those "inaccessible" spots with THOR Drills.

Many leading automotive manufacturers have expressed their confidence in THOR Drills by repeat orders. They have found that their super-power, combined with great speed and durability, actually **cuts their cost of drilling 80 per cent**—and increases their production accordingly.

THOR Drills will do the same for you.

Licensed under Burke Universal Motor Patent.

Investigate our agency proposition.

INDEPENDENT
PNEUMATIC TOOL CO.

600 W. Jackson Blvd.
Chicago, Ill.

JACOBS
CHUCKS
USED AS
REGULAR
EQUIPMENT

"SEARS-CROSS LOCK" FOR AUTOMOBILE DOORS

"The Lock With the Expanding Latch"

(MANUFACTURED UNDER THE OTTINGER PATENTS)



Lock No. 1200

NATIONAL SEAL COMPANY (Lock Department), Bush Terminal, BROOKLYN, N. Y.

**Prevents Rattling
Holds Doors Tight
Assures Positive Locking
Automatically Takes Up
Wear**

Combining quality and workmanship with these features the "Sears-Cross Lock" is the most perfect in use today.

Made for all priced cars, open and enclosed bodies

"Milwaukee" Patterns *Simplify Machine Shop Practice*

Time once spent in "roughing cuts" is now being better employed in shops where castings from "Milwaukee" Patterns are machined.

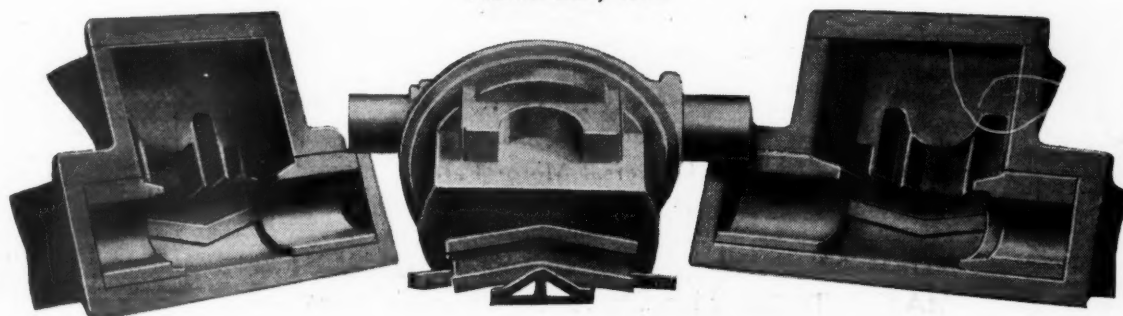
The accuracy of "Milwaukee" Patterns permits of rough dimension that closely approximates finished dimension. Our policy of considering every process which the

rough casting must pass through, and of planning for elimination or reduction of those processes, is causing our clients to establish unapproached production records.

To have us consider your needs places you under no obligation. Twenty years' experience is at your command. Command it.

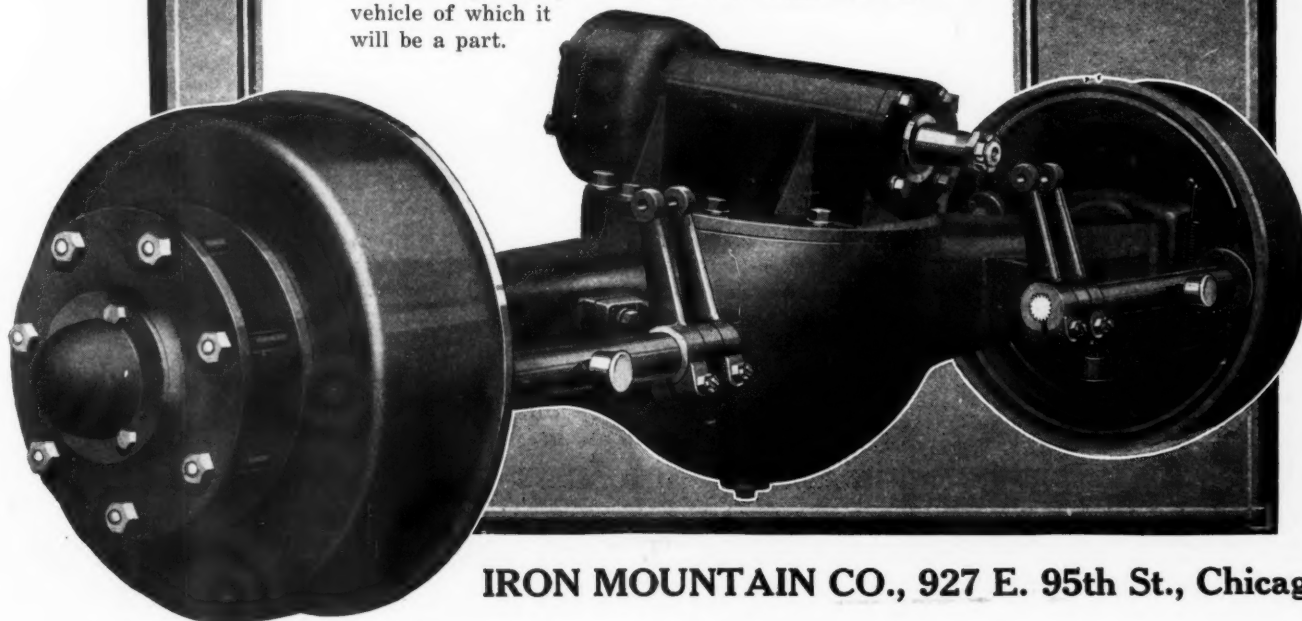
MILWAUKEE PATTERN & MFG. CO.

Milwaukee, Wis.



QUALITY IN AN AXLE

The qualities that enter into the fabrication of Iron Mountain Worm Drive Axles are there because of a thorough knowledge of truck manufacture and a desire upon the part of the manufacturer to develop to the highest possible point the product that will figure so importantly in the service record of the vehicle of which it will be a part.



IRON MOUNTAIN CO., 927 E. 95th St., Chicago

*for
durability*



ATLAS

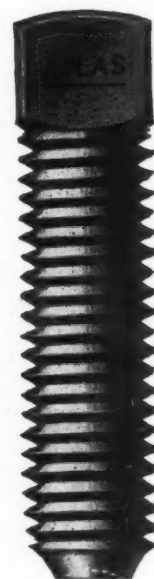
CAP AND SET SCREWS

Better made to withstand harder service—and increase the reputation of **your** product.

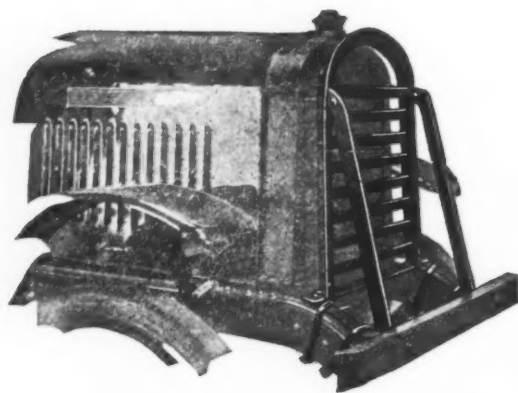
Try the Bolts, Nuts, Screws, Rivets that

"will not lose their heads."

THE ATLAS BOLT AND SCREW CO.
BOLT MAKERS *Cleveland, U.S.A. SINCE '96*



**Why a radiator guard should be standard
truck equipment—And why WARMAN should be specified**



More trucks, heavier trucks, higher speed, more congested and dangerous traffic—all of these factors unite to increase the liability of collisions that wreck radiators.

Truck buyers are on the alert for the smaller essentials of construction which make for economy and safety. And so the crying need for a radiator guard will make such equipment a decided selling point.

But unless design is right the radiator guard will not offer a full measure of protection. Warman design shows no weak spots. *Study it.*

LATERAL BARS—Set at angle of 45° to give maximum resistance and protection—permits free radiation as air is merely deflected.

STEEL FRAME—1 3/4 x 1 3/4 x 1/4 angle.

STEEL FORWARD BRACE—1 3/4 x 3/8.

STEEL LATERAL BARS—1 3/4 x 1/4.

1/2 IN. U-BOLTS—Clamp attachment to spring horn of chassis. Put on in a few minutes with ordinary wrench.

SHAPE OF GUARD—Differs to conform to radiator frames of various makes of trucks. Gives attractive uniform appearance.

FORWARD BRACE—Does not interfere with hood. Force of blow taken up by weight of chassis. Direct blow on brace pulls guard away from radiator instead of driving it in, as with a rear brace guard.

BUMPER—Attached to guard, optional.

Let us go into further details with you. What are your requirements?

THE FUNDAMENTAL CORP.

270 Union Ave.

Brooklyn, N. Y.

The
**WARMAN RADIATOR
GUARD**



SPOT WELDING

The *Thomson Method of Spot Welding* is saving many concerns throughout the country from 60 to 90% of what other methods cost them.

The range of Thomson Welding is almost unlimited. We are opening new fields every day.

May we prove to your satisfaction what we can save you?

Send for Bulletin SB.

BUTT WELDING

The *Thomson Method of Butt Welding* has been in use for over twenty-five years. Many of the first machines made are still performing at an immense saving for the owner.

Of course Thomson Butt Welders during all this time have been continually improved—so that now their accomplishments are almost unbelievable.

Send for Bulletin BB.

Thomson Spot Welder Company Thomson Electric Welding Company LYNN, MASS., U. S. A.

Buffalo: 595 Ellicott Square Bldg.
Chicago: 817 West Washington Blvd.
Cincinnati: Knowlton and Langland Sts.
Detroit: English & Miller Mchry Co., 1133
Majestic Bldg.
Duluth: Northern Machinery Co.

DISTRICT SALES OFFICES

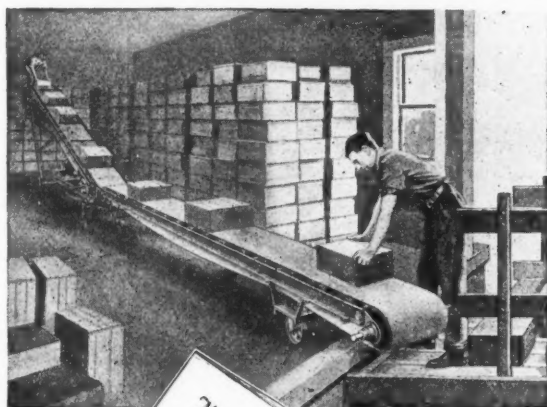
Grand Rapids: McMullen Machinery Co.
Kansas City: English Tool & Supply Co.
Lynn: 161 Pleasant St.
Minneapolis: Northern Machinery Co.

New York: 1604 U. S. Express Bldg.
Philadelphia: 1211 Widener Bldg.
Pittsburgh: J. S. Miller Mchry Co., 3
Wood St.
San Francisco: Charles A. Dowd Sales Co.
St. Louis: 208 Security Bldg.

FOREIGN BRANCH AGENCIES

Allied Machinery Company de France, Paris, France.
Allied Machinery Company d'Italia, Turin, Italy.
Allied Machinery Company de Espana, Barcelona, Spain.
Allied Machinery Company, Ltd., London, England.
Allied Machinery Company, c/o Benson Bros., Ltd., Sydney, Australia.

Lamson Conveyors



The above is just one of the many applications of Lamson portable level and inclined conveyors that are shown in the booklet "Making Labor More Productive." A copy will be sent to you on request.

Move It Anywhere About the Plant

Here is a Lamson portable conveyor that is always ready for service wherever it is needed. When a car or truck of material comes to the receiving room, use it for piling as shown in the picture. When a load of finished goods is to leave the plant, use it for shipping in the same way.

In manufacturing departments—in the yard—in fact anywhere about the plant, this convenient and effective conveyor will save its cost many times over in the time and labor it saves. It does the rough work of carrying and lifting and leaves men free to do the work that only men can do.

We shall be glad to point out ways in which you can save time and money by using these Lamson portable unit conveyors, or, if you prefer, send for the booklet "Making Labor More Productive", which shows many applications of the new conveyors.

THE LAMSON COMPANY BOSTON, MASS.

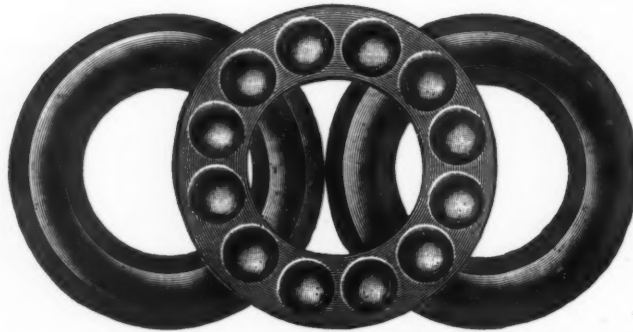
BRANCHES IN THE PRINCIPAL CITIES

DETROIT, 97 WOODWARD AVE. CLEVELAND, 2063 E. 4TH ST.



As Far As We Know, the NC-4 Did Not Have Any BANTAM BALL THRUST BEARINGS

20
YEARS
EXPERIENCE



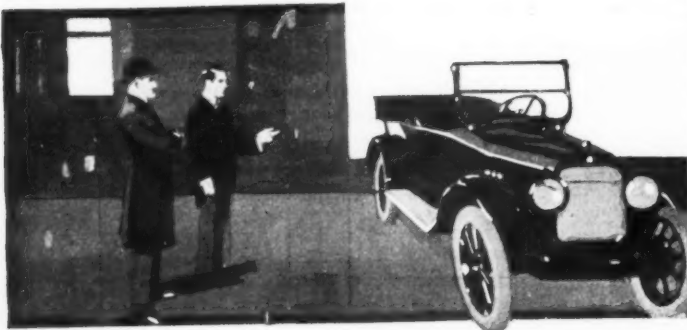
20
YEARS
SUCCESS

—but they have been used for twenty years with absolute satisfaction and success in the leading Automobiles, Trucks, Tractors, Aeroplanes, Motor Boats, Gas Engines and Machine Tools.

Made in the United States

Write Us for Details

THE BANTAM BALL BEARING CO. BANTAM, CONN.



What of the Finish?

The man who buys may be sold on the motor, the design and the chassis—but will he be pleased with the *looks of your car* after "a little driving?"

No question is more important to the manufacturer—it determines user satisfaction more than any other factor.

Hilo Baking Japans and Enamels are used because they have those properties which provide a durable finish that will "stand up" under continual wear.

A Hilo Service Salesman is ready to demonstrate the quality of our products in your factory.

HILO VARNISH CORPORATION

Formerly Moller & Schumann Co.

5 Gerry St.
BROOKLYN, N. Y.

2420-24 Washburne Ave.
CHICAGO, ILL.

Pacific Coast Distributors:
The Brininstool Co., Los Angeles, Cal.

A Hilo Finish for Every Automotive



CURTIS CRANES

Light, Safe and Easy to Move

Curtis I-Beam Cranes are preferred in many leading industrial plants for their safety and ease of operation. They are quickly erected at small cost.

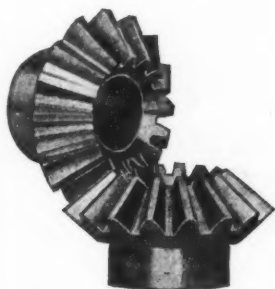
Equipped with Hyatt Bearings throughout. Made in various types, hand and pneumatic, in capacities up to 20,000 pounds and in spans up to 40 feet. All parts are extra strong, without excess weight.

Write for illustrated
descriptive literature

CURTIS PNEUMATIC MACHINERY CO.
1636 Kienlen Ave. St. Louis, U. S. A.

Branch Office:
531-r Hudson Terminal, New York City

Spurs
Bevels
Mitres
Spirals
Helicals
Worms
Worm Gears



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*The Most Remarkable
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Yet Produced*

Dridek Leather Double Texture

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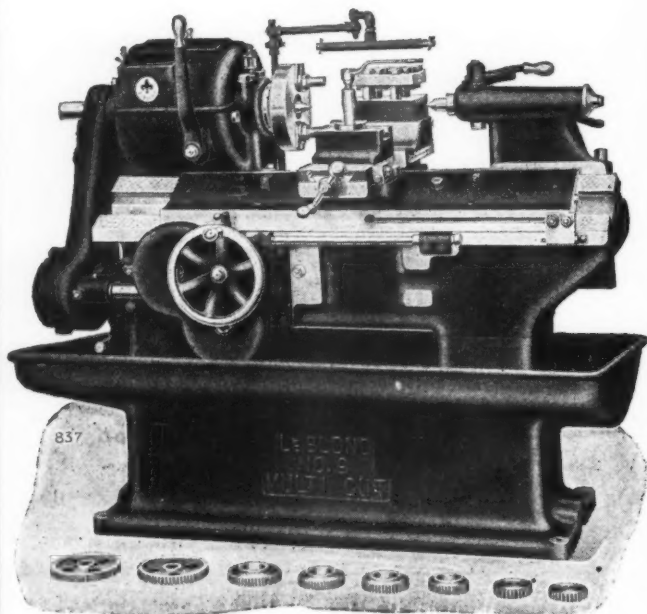
SPECIAL COLORINGS, GRAINS AND FINISHES
FOR THE NEW TYPE CLOSED CARS

Send to Dept. A for Samples and Prices

L. J. MUTTY COMPANY, Boston 9, Mass., U. S. A.

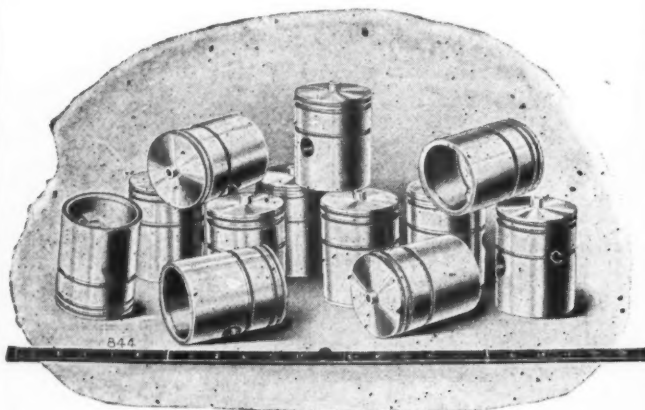


The Multi-Cut Finish Turns Aluminum Alloy Pistons in 20 Seconds Each



4 facing tools and 3 turning tools held in multiple tool blocks and ground to gage complete all turning and facing operations at one handling. The operator simply chucks the work and starts the machine.

Multi cutting guarantees definite savings over present methods.



The R. K. LeBlond Machine Tool Co.
Cincinnati, Ohio

WIRE WHEELS

HOUK

We are in a position to furnish wire wheels for practically every car made in America. Kindly specify make, model and year of car when writing for information or requisitioning quotations.

HOUSE

For FORD, CHEVROLET 490 and OVERLAND Model 4. Finished in White, Black, Red and Cream—color optional.

A set of Houk or House Wire Wheels consists of five wheels, four inner hubs, four hub caps, hub cap wrench, and spoke nipple wrench.

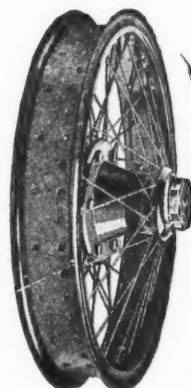
Dealers should send at once for the particulars of our service and sales agency proposition.

WIRE WHEEL CORPORATION OF AMERICA

(Successors to Houk Manufacturing Co.)

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McCrosky-SUPER Adjustable Reamers

If you need holes of standard size and finish, standardize on McCrosky-SUPERS. They will solve your reaming problems.

McCrosky Catalog No. 7 has the evidence.
Write for it today.

McCrosky Tool Corporation

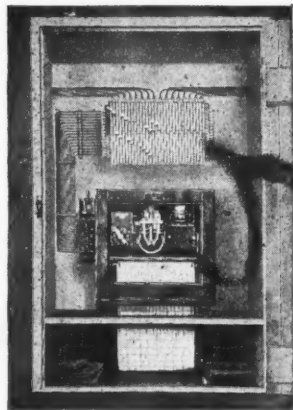
Meadville, Pennsylvania
Branches and agencies in all principal cities.

Temperatures of 1 to 16 Points Upon 1 Chart

The Leeds & Northrup Multiple Point Recorder uses the balance, opposition or zero method for measuring high temperatures with thermocouples or for precise measurements of low temperatures with resistance thermometers.

The accuracy of the record is unaffected by the length of run and resistance of lead wires, or by the calibration of the galvanometer.

The galvanometer serves merely as a current detector and pilot to bring about the re-adjustment of the potentiometer or Wheatstone bridge whenever the temperature changes. The actual work of adjusting and of making the record is done by outside power.



When used in connection with thermocouples, an automatic cold end compensating device is included within the recorder casing.

State the class of work in which you desire to measure temperatures and literature describing the Leeds & Northrup Recorder and the type of thermometer or pyrometer suited to your purpose will be sent.

LEEDS & NORTHRUP CO.

4919 Stenton Avenue, Philadelphia, Pa.

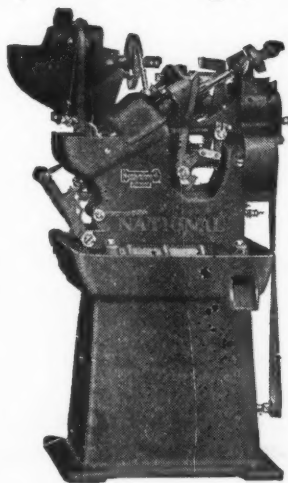
Makers of Indicating, Recording and Signalling Resistance and Thermocouple Pyrometers, Optical Pyrometers, Apparatus for Determining the Transformation Points of Steel, Automatic Temperature Controlling Apparatus and Apparatus for the Hump Method of Heat Treatment

10

Why

do all the big Nut Plants and Industrials use the

National Automatic (Bent Tap) Nut Tapper



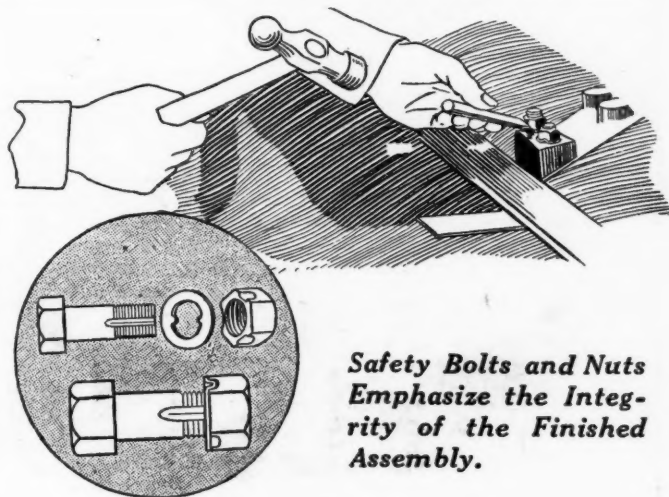
in tapping nuts for automobile, truck, aeroplane, motorcycle, sewing machine, electrical, and for other particular service?

If you make good quality nuts in appreciable quantities it will pay you to investigate.

The National
Machinery Co.

Tiffin, Ohio, U. S. A.

These Bolts Will Not Loosen



*Safety Bolts and Nuts
Emphasize the Integrity
of the Finished
Assembly.*

Old age and feebleness come quickly to many a good car simply because the bolts and nuts that should hold it together loosen and break, or drop out.

The Stevenson Safety Bolt and Nut cannot loosen. It, therefore, will not drop out or break from uneven strain.

The car manufacturer, by using Stevenson Nuts and Bolts, adds 90 per cent to the usage value of his car. By Stevenson simplicity, he gains 20 per cent of the time ordinarily consumed in bolt-up.

The Safety Bolt and Nut Assembly consists of a bolt with tapered grooves, a washer with inner lugs that fit the bolt grooves, and a nut with chucks in its lower outer faces. When nut and washer are brought home to contact, the outer rim of the washer is upset into any chuck with one blow of a hammer on a chisel. The lock so formed is permanent.

To unlock, back down the bent-up portion with one blow from a chisel.

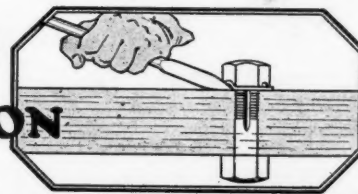
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THE SAFETY NUT & BOLT COMPANY

Dept. A.

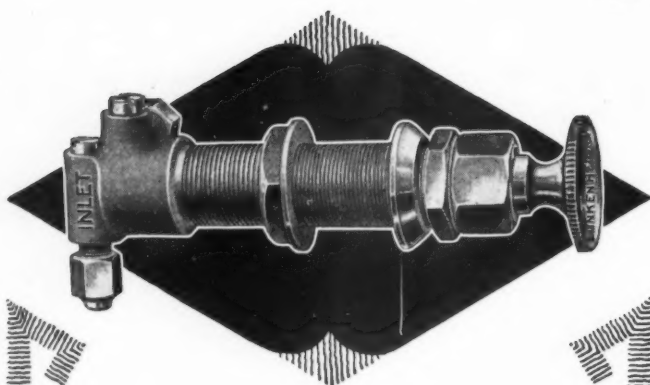
Cleveland, Ohio

ONE BLOW LOCKS IT
ONE BLOW UNLOCKS IT



STEVENSON
SAFETY

NUT & BOLT



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Makes starting easy, regardless of the grade of fuel or atmospheric temperature because it injects a charge of atomized gasoline directly into the intake ports, giving a power impulse on the first turnover.

It saves the starter battery, makes priming a safe and convenient operation, and prevents the accumulation of carbon in the cylinders, caused by the excessive use of the carburetor choke.

The Lunkenheim Primer is easily attached, connections being furnished for all makes of cars. Its installation means safety, convenience and economy.

Leading dealers everywhere sell Lunkenheim Primers. Write for descriptive booklet No. 513-HK.

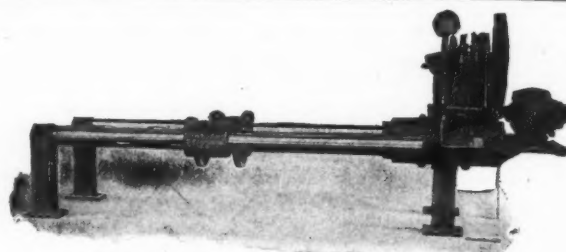
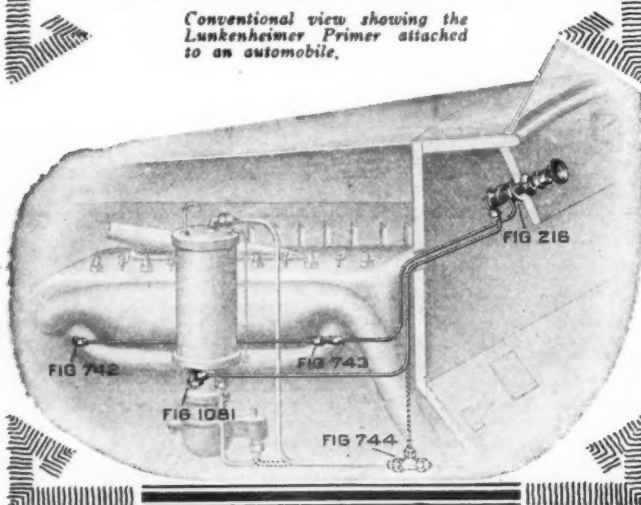
THE LUNKENHEIMER CO.
"QUALITY"

Largest Manufacturers of
High Grade Engineering Specialties
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CINCINNATI

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Conventional view showing the
Lunkenheim Primer attached
to an automobile.



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FOR RAPID ASSEMBLING OF FORCE FIT PARTS

This is a handy type of press for forcing gears, sleeves, bushings and other shop operations requiring accuracy.

It has a capacity of 200 tons; maximum opening, 30x84 inches. Its open horizontal construction allows placing of work either from the floor or overhead crane.

The pump is a self-contained unit and can be placed as shown in the illustration or in any other convenient position, for motor or belt drive.

Our line includes punches, shears, shaft-straightening presses, broaching presses, pumps, benders, accumulators, valves, fittings, etc.

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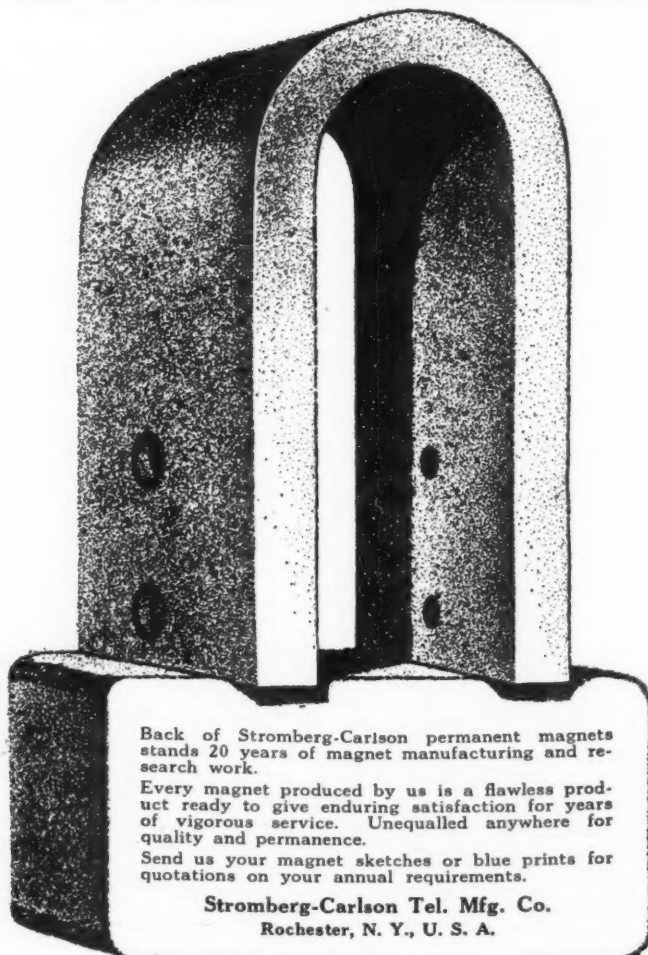
CHICAGO: 1500 McCormick

Building

PHILADELPHIA—Widener Bldg.



214



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Every magnet produced by us is a flawless product ready to give enduring satisfaction for years of vigorous service. Unequalled anywhere for quality and permanence.

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and airplanes*

Bush Manufacturing Co.
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INSURANCE CO. OF NORTH AMERICA
232 Walnut St., Philadelphia

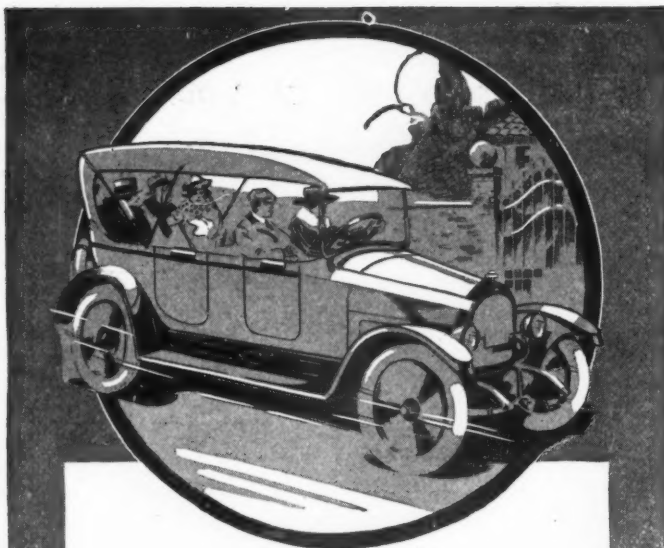


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In the making of manifolds, nipples and cleats for electrical wiring, **VUL-COT** Fibre has proven to be especially serviceable.

Vul-Cot Fibre

(A higher development of Vulcanized Cotton Fibre)



for facings of friction clutches and for brake bands meets every condition of reasonable use.

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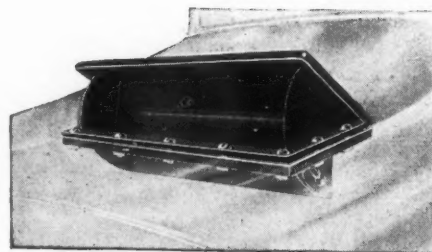
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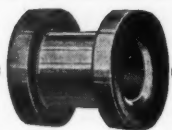
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In Unity There Is Strength

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The Standard Commutator is built to withstand the rough handling to which commutators are sometimes subjected when forced upon the shaft or while being assembled with the armature and other parts of the motor or generator.

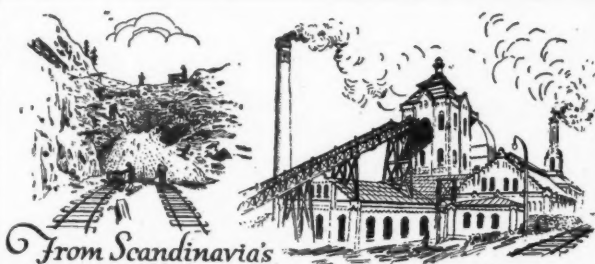
We are supplying some of the largest commutator users in the country, and are constantly increasing our production. We are delivering one hundred and ten thousand Standard Commutators to one consumer alone. If you

are in the market for commutators we will gladly have our representative call upon you. Designs to suit your requirements, together with prices, will be promptly submitted upon request. Send us your specification.

The Toledo Standard
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Toledo, Ohio.

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*the World's Finest High Carbon Strips
Tempered & Highly Polished and
Bright Cold Rolled to take a high temper.*

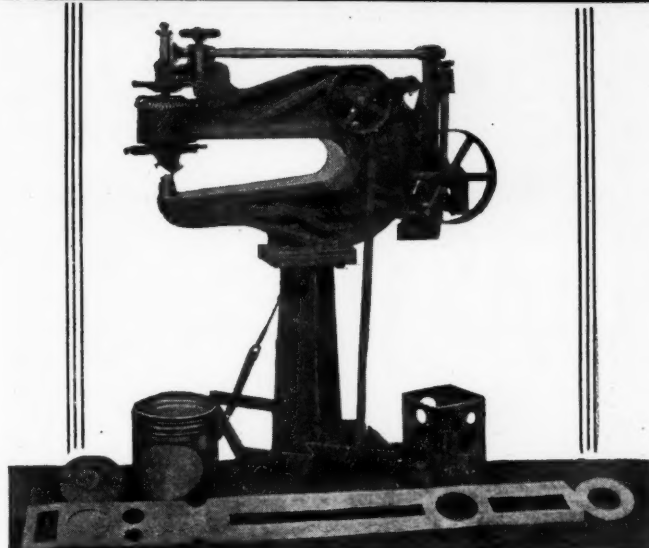
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SHEET
AND
PLATE
METAL

SHEARING REVOLUTIONIZED



Gray's Turret Rotary Shear Cuts Any Shape Without Swinging Sheet

Because the cutters, while working, can be changed to any degree of a circle, the shear illustrated will cut without turning the sheet, any shaped openings in widths equal to double the throat depth and no limit of length. Intricate turns and small radii are cut under power. The simultaneous driving of both cutters pulls the sheet through the shears automatically. The line to be cut is accurately followed by means of the turret, which is controlled by the guide wheel.

Shears Inside Shapes Without Starting from Edge

The holes in the cans and in the sheet, which is three times as long as the throat depth, show some of the things that can be done on this shear. The same cuts can be made in a sheet ten or a hundred times as long. The turret does it.

Reduces Cost of Shearing from 50% to 90%

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To supply A. B. C. reports on its circulation is good business practice on the part of any publication and the Automotive Industries is glad to render this necessary service to advertisers.

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WIRE

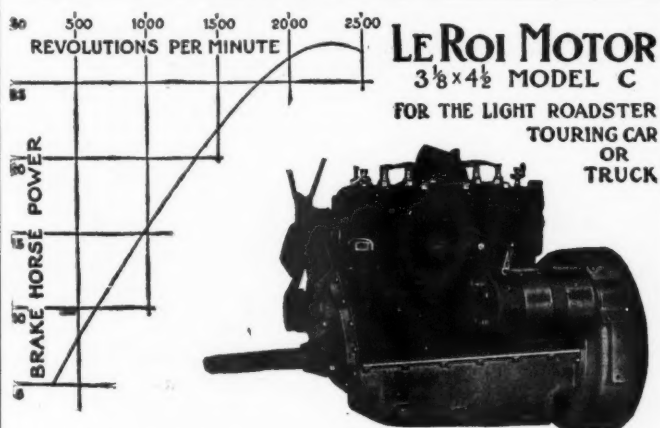
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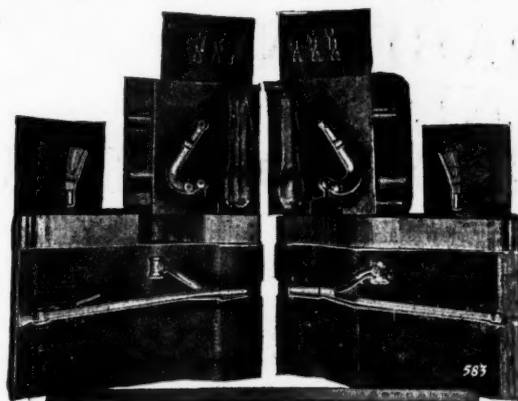
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Do you realize how greatly Keller Automatic Machines can improve the quantity and quality of work in your plant? Always to have dies ahead—steady flow of production—no delay and scrapped work from worn dies.

The Keller Automatic Die Sinking Machine is the only one of its kind. Since the pioneer Keller types were placed in service improvement after improvement has been added.

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Automatic Die Sinkers

KME-30

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HARDENED AND GROUND PARTS

Our large and completely equipped factory is prepared to produce such automotive parts as wrist pins, valve tappets, etc., requiring special hardening and grinding processes in quantity and to highest quality standards. Get in touch with our Engineering Department for quotations and delivery schedules.

STANDARD AUTOMATIC TOOL CO.
RACINE, WIS.

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Assure a positive start, regardless of fuel gravity or temperature conditions.

Carburetion engineers have long appreciated that the ideal place to heat the fuel is in the nozzle, where atomization takes place. This is what the Columbia Carburetor does.

With the heaviest fuel, and the coldest weather, the heating element, which is an incorporated part of the nozzle, raises the fuel gravity and allows of minute subdivision. By heating only that fuel contained in the nozzle, the utmost efficiency is obtained.

Starting on the first turn of the engine, the current drain, which in winter sometimes amounts to 500 amperes, is consumed for only a short time. This insures long life to the battery.

Columbia Carburetor Company
Chicago Illinois



What Aluminum Bronze Die Castings Mean—Why the Name "Buffalo" Stands Alone in Their Production

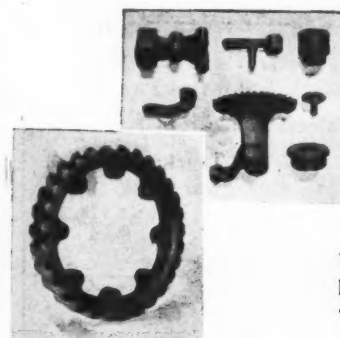


Aluminum Bronze is the final word in strength, toughness and the quality of long wear—but until we made die casting of this alloy commercial, practical and economical, inferior metals have, perforce, been used.

Buffalo Aluminum Bronze Die Castings range from worm gear wheels on down to the smallest requirements in this line.

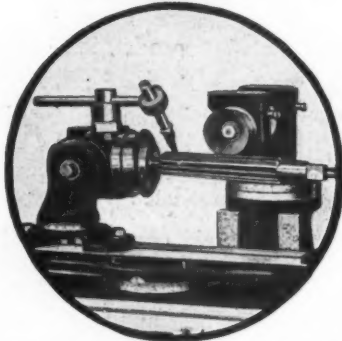
Through our accurate methods we are turning out work in aluminum bronze that eliminates machine finish to a great extent.

When you think of Aluminum Bronze Die Castings, think of "Buffalo." This is the name back of the product.



Buffalo
BRONZE DIE CAST CORP.

Buffalo, New York



Grinding Face of Teeth on Taper Reamer

The centers are brought in line with the face of the grinding wheel and the work-head raised to bring bottom of the tooth parallel with table. Tooth rest is clamped on top of work-head and adjusted to bear against the heel of the tooth. This method insures rapid handling and super-accuracy.

The Oakley No. 2 Grinder not only sharpens rapidly and accurately any style of saw, milling cutter, tap, etc., but with complete attachments will handle any cylindrical, internal or surface grinding job within its range.

In fact, this machine will handle any and all grinding jobs found in a tool-room. Unusual rigidity and convenience in operating makes for the speedy handling of super-accurate work. Write for bulletins TODAY.

The Oakley Machine Tool Co.
Cincinnati Ohio

The **OAKLEY NO. 2**



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Lubricating qualities of oil are superior to grease because the feed can be controlled. THE BLOOMING CUP scientifically applies a simple law of nature as old as the Sun regulating the feed of the oil. No waste. Two or three thousand miles with one filling of cup, perfectly lubricating bearings.

Perfect Lubrication Every Drop Counts



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SALES DEPARTMENT 2113 DIME BANK BLDG.
MANUFACTURED BY BLOOM FLUSHER COMPANY TIFFIN, OHIO

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The Snead shaft is of electrically heat-treated, light-walled, nickel steel tubing, remarkably strong and unusually resilient.

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Address Dept. S.

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DETROIT TRANSMISSIONS



FOR TRUCKS

Unit Power Plant Type for Trucks of 1, 1½ and 2-Ton Capacity—3 Speeds

Detroit Gear & Machine Co.
Detroit, Michigan

Model C



Lubricant enters Through the Grooves in Bushing to all Bearing Surfaces.

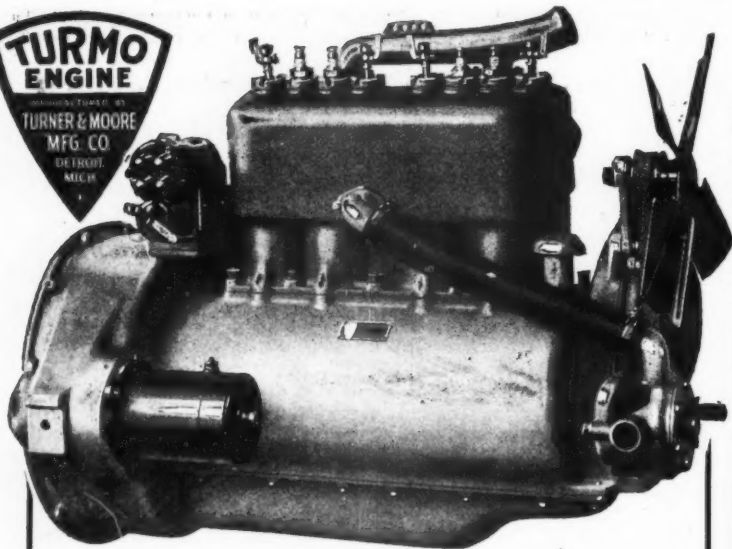
All Bearing Surfaces Are Flooded with Oil

The only metal-to-metal Bearing Surfaces in the A. B. Universal Joint are the four bushings or bearings. These are constantly flooded with oil. The centrifugal force, which results from the rapid rotation of the joint, throws the oil into the grooves in the face of the bushing. (See cut.) It is compelled to rush inside the bearing and lubricates the only metal-to-metal bearing surfaces found on the A. B. Joint. Write for descriptive literature.

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SOUTH EASTON, MASS.

A.B. Universal Joint

Centrifugally Forced Lubrication



Turmo Four Cylinder Engines

Two Sizes: 3 in. x 5 in. and 3½ in. x 5 in.

Full pressure gear pump lubrication through hollow crankshaft to all bearings.

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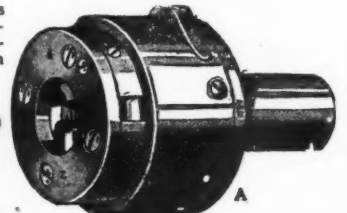
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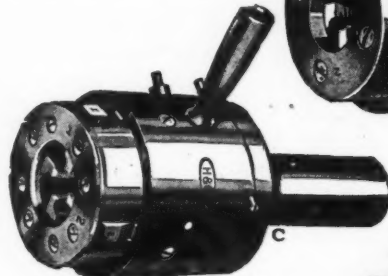
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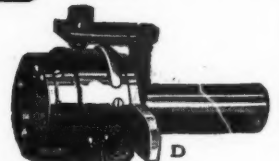
Style A—is for automatics like the Cone, Gridley, National Acme, and threading machines and bolt cutters in which the diehead rotates.



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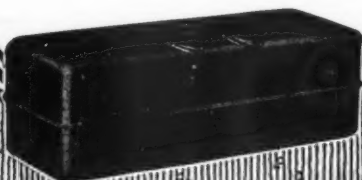
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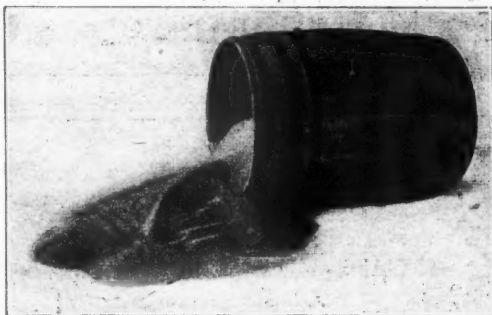
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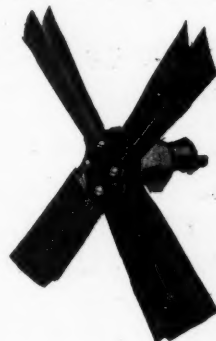
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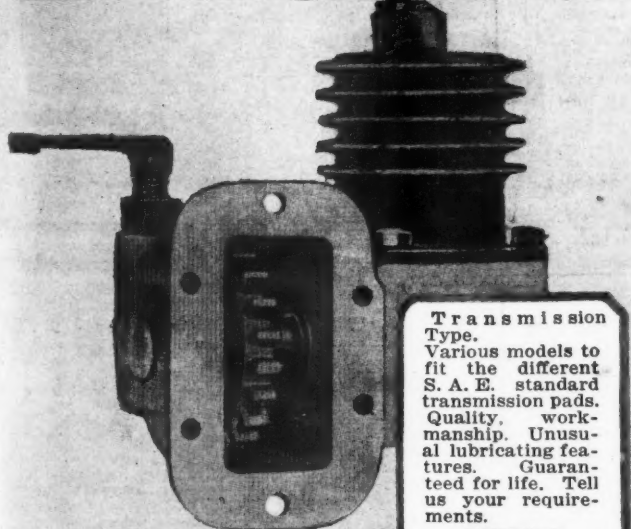


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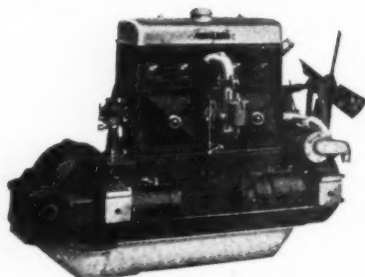
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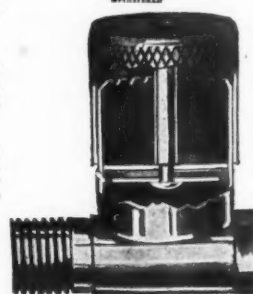
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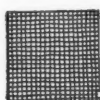
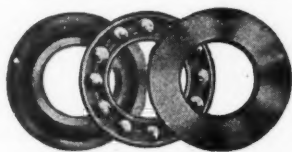
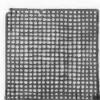
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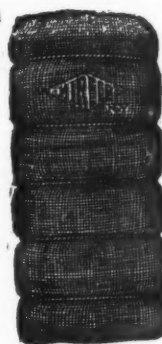
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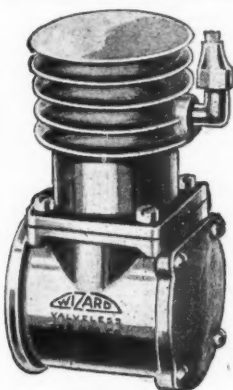
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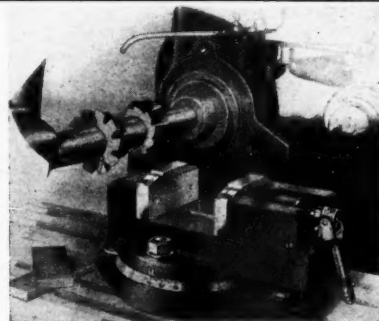


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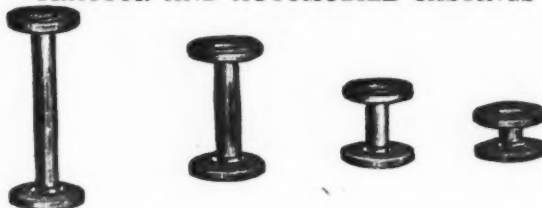
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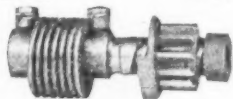
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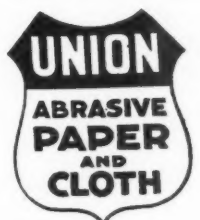
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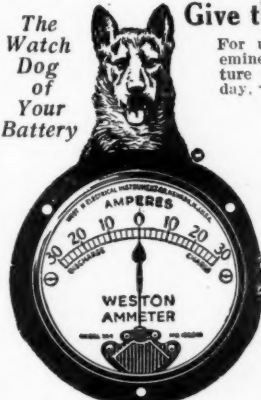
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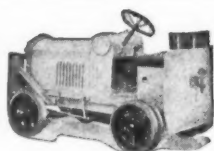
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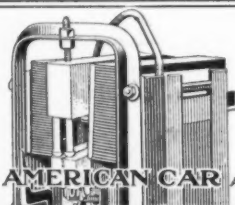
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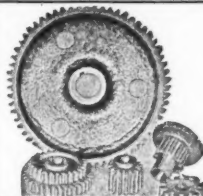
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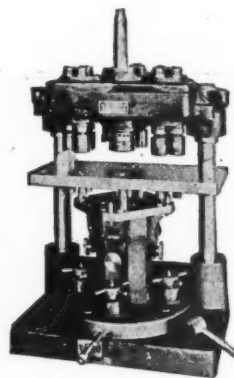
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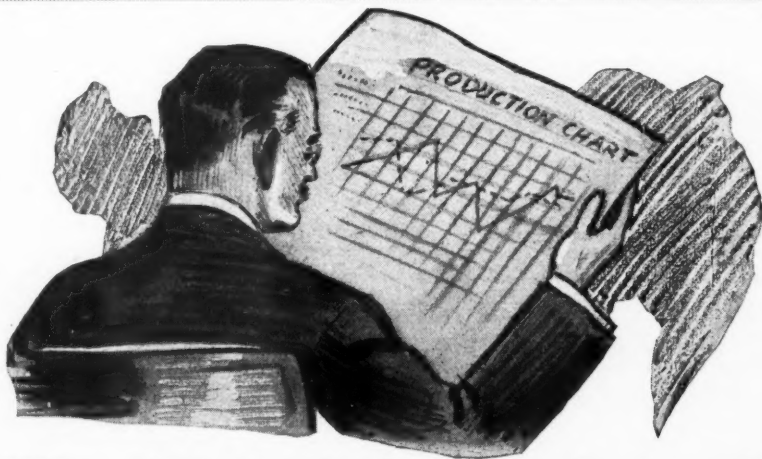
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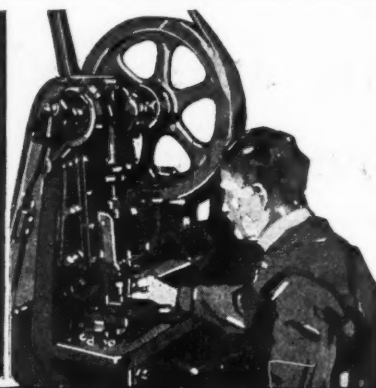
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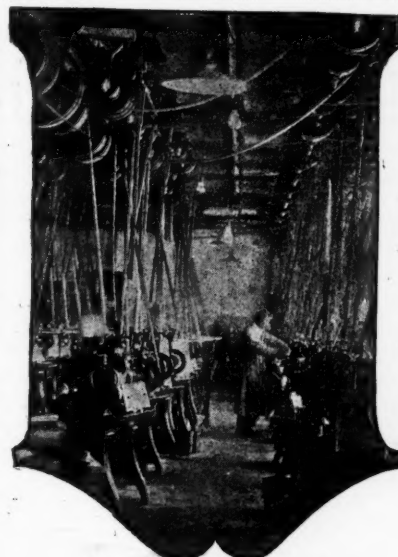
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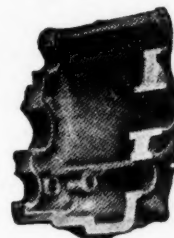
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It is also important that you state whether you are in a position to finance the proposition, or if it is to be manufactured on a royalty basis.

For co-operation along the above lines, address

AUTOMOTIVE INDUSTRIES

Service Department, Contract Work
239 WEST 39th STREET, NEW YORK CITY



Manufacturing and Merchandising Opportunities

A SPECIAL SERVICE TO OUR ADVERTISERS

The items appearing in these columns form a part of the inquiries received by our Contract Work Service Department during the past three weeks. Manufacturers or concerns interested in these or similar inquiries can secure full information as to how this service is operated by communicating with the Contract Work Service Department, Automotive Industries, 239 W. 39th Street, New York City.

6583 A corporation in Cleveland wants to get in touch with concerns who can supply screw machine work; also punch press work.

6584 Interest back of this inquiry wants to get in touch with those who can supply malleable castings, punch press work (cupped washers from pressed or sheet steel; set screws from $\frac{3}{4}$ cold roll).

6585 A Pittsburgh corporation would like to receive quotations, with a view of subletting to outside concerns, on passenger auto bodies, sheet metal work (mud guards, hoods, etc.).

6586 A San Francisco company wants to get in touch with concerns who can supply malleable castings, grinding, lathe and milling machine work, metal stampings, metal patterns, plating and japanning, coil springs, and tool and die work.

6587 Interest back of this inquiry seeks communication with concerns who can supply dies, gear cutting, grinding, lathe and milling machine work, machine parts, metal stampings, punch press and screw machine work, coil springs, and tool and die work.

6588 A Dayton, Ohio, company desires to be put in touch with concerns who are equipped to handle dies, grinding, lathe and milling machine work, screw machine and tool and die work.

6589 Interest back of this number is interested in receiving quotations on dies, grinding, lathe and milling machine work, machine parts, screw machine and tool and die work.

6590 A Baltimore corporation wants to receive quotations from concerns who can supply steel and gray iron castings, dies, forgings, wood and metal patterns, tool and die work and welding.

6591 A Kansas City, Mo., concern would like to get in touch with those who are in a position to supply gray iron and steel castings.

6592 Interest back of this inquiry desires to get in touch with those who are in a position to supply bronze forgings and metal stampings.

6593 Interest back of this inquiry would like to get in touch with concerns who can supply lathe and milling machine and iron foundry work.

6594 A Connecticut corporation desires to get in touch with concerns who are equipped to supply and quote on screw machine work and coil springs.

6595 A Western company would like to receive communications from organizations who can supply hollow vulcanizing castings.

6596 Interest back of this inquiry wishes to get in touch with concerns who are equipped to handle and quote on steel castings.

6597 A company in Detroit is interested in receiving quotations, with a view of subletting on castings (malleable or crucible steel), metal stampings, and screw machine work.

6598 Interest back of this number wishes to get in touch with those who can supply screw machine work.

6599 A New England organization desires to get in touch with concerns who can supply aluminum castings, gear cutting (tempering steel), machine parts, punch press work, screw machine and sheet metal work.

6600 A Chicago company seeks connection with concerns who can supply gray iron castings (light section gray iron).

6601 Interest back of this inquiry wants to get in touch with concerns who are equipped to handle lathe and milling machine work, and malleable metal stampings.

6602 A Minneapolis, Minn., correspondent who has a device known as a valve cap desires to make arrangements with a concern that can manufacture and share in the profits of this invention.

6603 Interest back of this inquiry has invented, patent applied for, a spot light, and would like to make arrangements to have it manufactured and placed on the market on a royalty basis.

6604 This correspondent has invented and received patent on an auto rattling device which does away with the rattling of hoods on an automobile, and desires to sell patent on a royalty basis or will consider other arrangements.

6605 Interest back of this number has designed a non-skid-tire-tread and is seeking financial co-operation; will consider royalty basis arrangement or otherwise.

6606 A Long Island inventor has secured a patent on an automatic road guide, designed to take place of map, books and sign posts, and wants manufacturing and marketing co-operation.

6607 A company in the South has developed a device to be integral part of carburetor that will eliminate the use of a separate vacuum tank; will consider royalty basis arrangements or otherwise.

6608 A New York City inventor has interest in a patent for cylinder grinding machine which he wants to place on the market, and seeks financing co-operation or royalty basis arrangement.

6609 The foregoing is the inventor of an all-steel pneumatic wheel for automobile trucks; wants assistance on royalty basis or other satisfactory arrangements.

6610 A Western company has invented a truck hoist for garage work for loading and unloading trucks; wants to sell on a royalty basis or will consider other arrangements.

6611 A corporation in the South has a rim tool that they wish to put on the market; desires to get in touch with reliable concerns who manufacture articles of this kind.

6612 Interest back of this number has patented a device called spark and gas lever for control of motor vehicle engines for one-armed folks so that they may successfully drive, and seeks manufacturing and marketing co-operation.

6613 A correspondent located in Spokane, Wash., has invented a day and night signal for automobiles, and wishes to get in touch with some one who will take over manufacturing of device on royalty basis.

6614 A correspondent in Washington, D. C., has invented an autolock and desires to have some manufacturer take hold of this device; that is finance its production on a royalty basis.

6615 Interest back of this inquiry has a new device, the magnetic trouble light and pick up; seeks financial co-operation or will consider other arrangements.

6616 A company located in Chicago is in the market for quantities of straight-side and cylinder rims in all sizes, split circumferentially.

6617 Interest back of this number desires to get in touch with those who can supply steering ball sockets and studs, such as used in commercial trucks, in small quantities.

6618 A correspondent located in Oklahoma has patented a small fuel saver and carbon preventer; wants to get in touch with some manufacturing concern who will manufacture this device.

6619 A New England corporation is planning to produce a new timer device, and desires to get in touch with a concern who can furnish porcelain shells, open for five-year contract.

6620 Interest back of this inquiry is interested in marketing and manufacturing arrangements with two plants of at least 60,000 square feet—one plant in the Middle West and one in the East; object, to build complete tractors.

6621 A tractor company in Minneapolis, Minn., desires to locate with a concern that is in a position to build one-cylinder, four-cycle gasoline engines; will arrange with concern to manufacture a minimum of 5000 machines per annum.

6622 Interest back of this inquiry has a new steering-sled invention about to be placed on the market; they are organizing a company and desire to get in touch with manufacturers who can get out a few thousand of these sleds at an outright figure.

6623 A correspondent located in Tennessee desires a small lathe of about 9 to 11 inches swing; prefers one of standard make that operates by foot power.

6624 Interest back of this number is in a position to place immediate contracts for machine screw work on small parts.

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Automotive Industries, 239 W. 39th St., New York City

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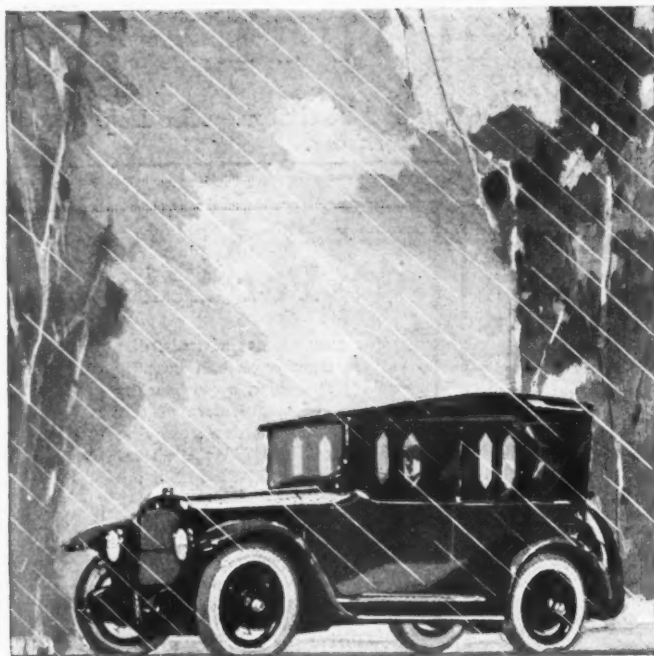
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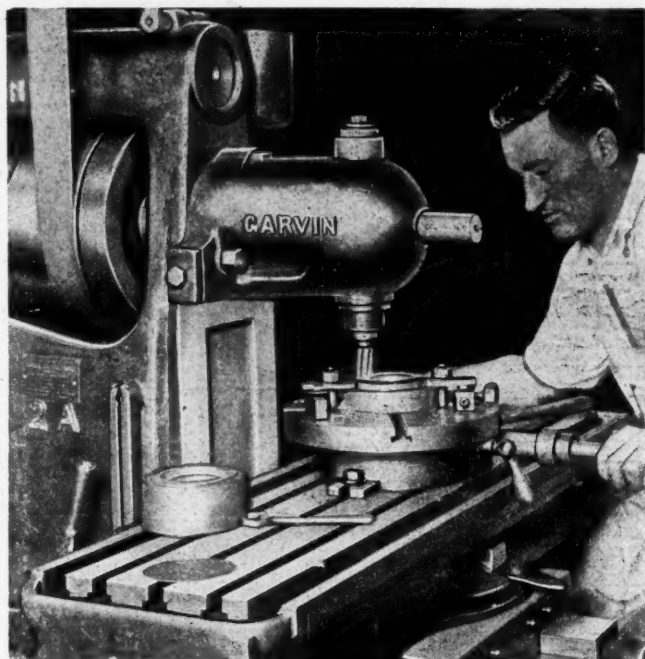
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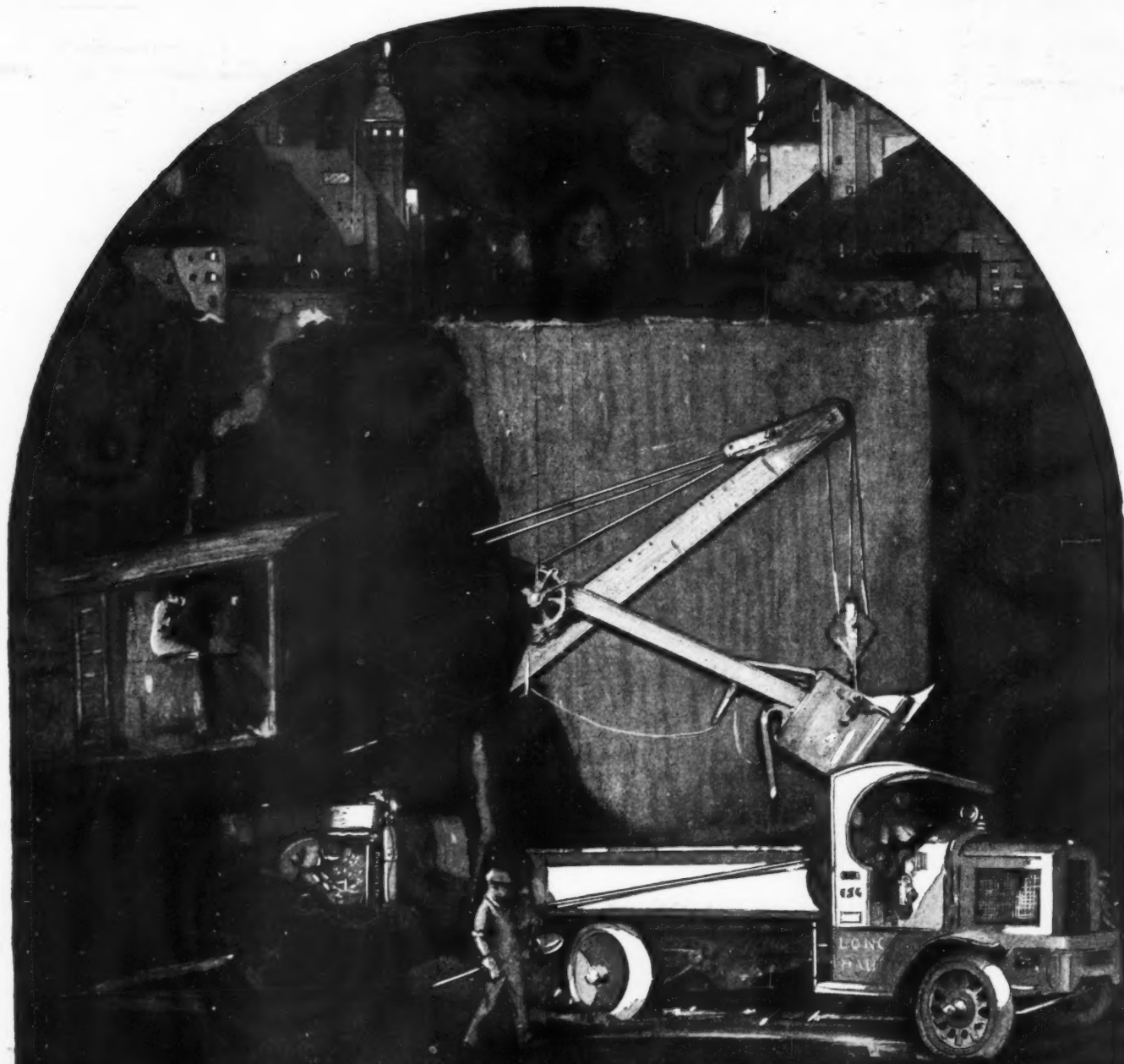
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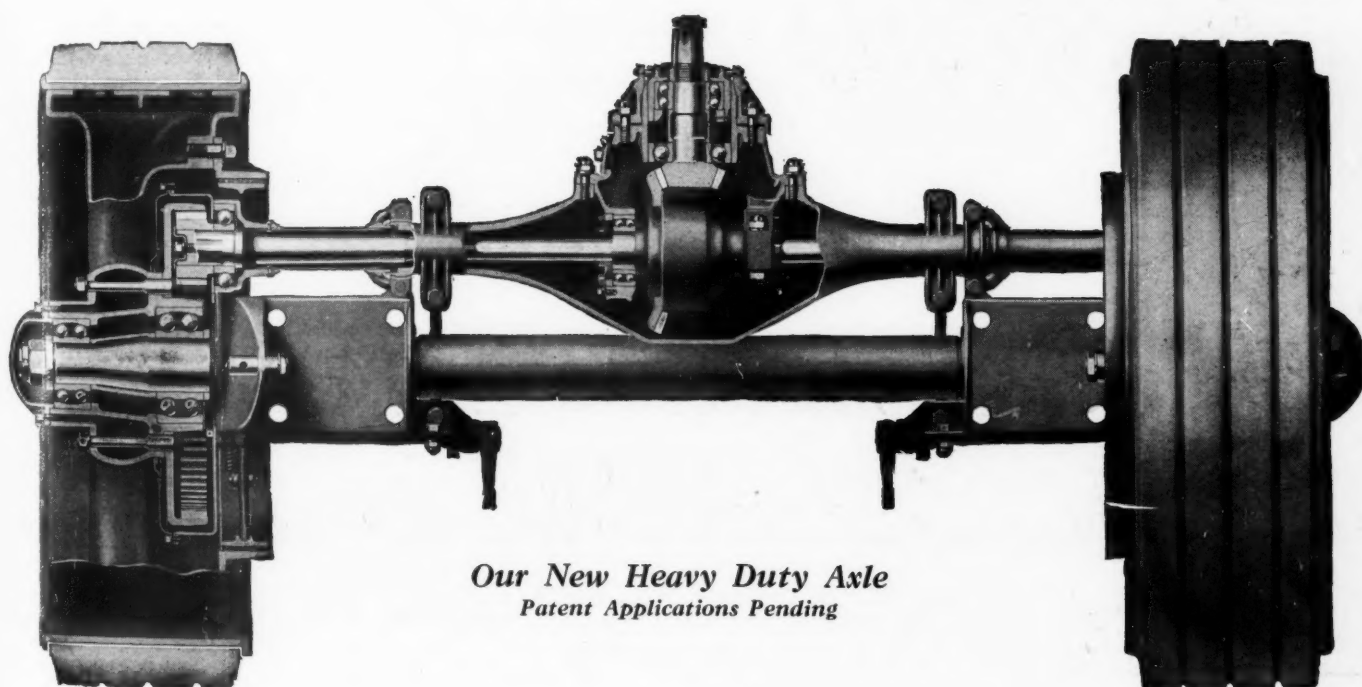
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